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PROSPECTS OF USING IMMOBILIZED ENZYMES IN MEDICINE

Kiev UKRAINSKIY BIOKHMICHESKIY ZHURNAL in Russian No 4, 1979 pp 409-419

[Article by K. N. Veremeyenko and G. F. Karpenko, Kiev Scientific Research Institute of Otolaryngology imeni A. I. Kolomiychenko, Ukrainian SSR Ministry of Public Health, Kiev]

The data in the literature concerning the basic trends in the use of immobilized enzymes in different fields of medicine are correlated. The role of liposomes as a means of transporting enzymes to the intended site in lysosomal disorders is covered. Information is presented on the opportunities for using bound enzymes in therapy for a number of pathological processes (pyo-inflammatory processes, thromboses, malignant neoplasms and others). The prospects of using immobilized enzymes as specific reactives for determination of biosubstrates and products of metabolism for diagnostic purposes is examined.

[Text] Research data of recent years indicates the high therapeutic effectiveness of enzymes and their inhibitors in treating many diseases (1-5). Hydrolytic enzymes have received the widest application in practical medicine, particularly proteases obtained from biological subjects of different origins (6). They are characterized by necrolytic, mucolytic and anti-inflammatory properties and also the ability to intensify the action of antibiotics and other medicinal substances (2). Among the large group of proteinases the specific enzymes of fibrinolysis, which have a thrombolytic effect, are of considerable interest. Preparations of plasmin and the activators of plasminogen (streptokinase, urokinase) are intensively applied as medicinal substances in combatting thromboses, myocardial infarcts and other disorders (7).

Despite the undoubted therapeutic effect of hydrolases, particularly proteinase, their wide use in clinical practice has been impeded. First, this is related to the low stability of the enzymes, their capacity to undergo autolysis in a neutral medium, with loss of their catalytic properties. Second, on entering the blood and injured tissue, hydrolytic enzymes bind

with inhibitors with the result that their activity is completely or partially lost. Third, when enzymes are injected into the blood in soluble form selective creation of the effective concentration of them in the necessary part has not been possible, owing to equal distribution of them throughout the entire organism. Increase in the concentration of xogenously introduced enzymes, however, results in undesirable side reactions. Moreover, the immunogenic properties of the enzymes limits their wide application in medicine.

In recent years it has been possible to a significant degree to eliminate the indicated drawbacks of soluble enzymes thanks to development of methods for obtaining immobilized enzymes by joining native forms to different matrices (8). In this case the modified enzymes retained their specificity, became more resistant to the influence of temperature, were less influenced by by endogenous inhibitors and had insignificant antigenic properties (9). When enzymes bound with a carrier is injected into tissue it is possible to create higher local concentrations of them.

There are a number of requirements for carriers, which may be both mineral and organic substances: resistance to the pH of the medium and to temperature, hydrophility, a large specific surface and the absence of the influence of the matrix on the enzyme (10). Moreover, carriers intended for medical purposes must be biocompatible, heterogeneous, nonantigenic and must not have a toxic or carcinogenic effect. In Gregoriadis' descriptive expression (11), "the carrier must act at home in the organism, transfer its contents and finally undergo break-down." The most acceptable matrices for obtaining the bound enzyme preparations used in medicine are polysaccharides, proteins and, as was recently demonstrated, liposomes (11).

At present the following basic ways of using immobilized enzymes in medicine have been noted. It is sound practice to use them for:

1. Eliminating a deficiency in the gastro-intestinal tract and also in tissues in a number of hereditary diseases;
2. Elimination of different complex denatured structures which are heterogeneous in chemical composition and cellular and tissue fragments;
3. Lysis of thromboses and in making prosthetics for vessels;
4. Comprehensive therapy for malignant neoplasms;
5. Treatment of diseases associated with activation of a number of enzyme systems (immobilized inhibitors of the enzymes are used);
6. Elimination of toxic substances from the organism;
7. Detection and quantitative of chemical substances in the blood and tissues (as specific reactives).

Great prospects are opening in connection with use of immobilized enzymes in treating diseases caused by complete or partial absence of enzymes. They may be delivered to the intended site comparatively easily in those cases when a deficiency of the enzymes in intracellular fluids and digestive juices has been detected. For purposes of replacement therapy preparations containing a mixture of digestive enzymes which break down carbohydrates, proteins and fats are administered. They are characterized by their multi-component nature, and they act on the entire length of the gastrointestinal tract (for example, panzinorm forte is released in the form of two-layer tablets with an acid-protective coating) (12).

At present attempts are being made to obtain microcapsulized complex enzymatic enteral preparations using the method of reversible immobilization of hydrolase by cross-linked gels of polyelectrolytes (carboxyl cationite) (13). Such a method makes it possible easily to obtain enzymes with higher than usual resistance to gastric juice and to facilitate the release of native enzymes in the intestine.

An important problem in replacement therapy is the use of enzymes and their derivatives in treating hereditary diseases. At present more than 500 genetic diseases caused by synthesis of a mutant enzyme with sharply decreased activity are known.

In order to treat hereditary diseases (glycogenoses, mucopolysaccharidoses and lipidoses) attempts have been made to inject the missing soluble enzymes into the organism. Encouraging results have not been obtained, however, owing to the difficulty which exogenous enzymes have in penetrating cells, their rapid degradation under the influence of serum and tissue proteases, accelerated elimination from the organism and the presence of immunological reactions (14). In connection with this searches were begun for medicinal forms of enzymes which would be protected from the destructive influence of endogenous proteinases and from contact with blood proteins and substrates located on the cell surface. Artificial and natural biological membranes which might be capable of isolating the protein molecules of the enzymes from the environment were used for this purpose. Sessa and Weismann (15) demonstrated that when the phospholipids (yolk phosphatidyl choline) swelled in a water medium containing lysozyme, lipid bubbles form consisting of one or several concentric phospholipid layers alternating with sections of water, in which the enzyme is located. These formations have been named liposomes. The enzymes retain their activity in them, and the lipid membrane must be destroyed with detergent in order for it to be detected. When injected into the organism liposomes circulate in the blood longer than do free enzymes, a fact which is explained by the multilayer nature of the liposomes and the gradual release of enzymes from them as the result of the destruction of the membrane of the lipids by the enzymes of the lysosomes. The rate of elimination of lysosomes from the general circulation depends on the charge on the surface and on their size. Positively charged liposomes are eliminated at a lesser rate than negatively charged ones (16). Liposomes containing enzymes are taken in predominantly by the liver and the spleen. Thus, neuraminidase included in a liposome is detected in the spleen (3.5-5

percent) and liver (20-26 percent), chiefly in its lysosome fraction (60-69 percent) when administered to rats. Moreover, in distinction from the free enzyme, the neuraminidase contained in liposomes does not act on the substrates of the plasma and on the surface of the erythrocytes (17).

The mechanism of the entry of the enzymes of the liposomes into the cell is schematically represented by the figure (11): the enzyme incorporated in the liposome penetrates the cell through endocytosis. The endocytic vacuoli merge with the lysosomes. The enzymes of the lysosomes destroy the lipid membrane of the liposomes; the enzyme is released, and it acts on the corresponding substrate.

Other mechanisms of the penetration of liposomes into the cell in addition to endocytosis are: direct merging of the lysosomal and the plasmatic membrane of the cell and penetration of the contents of the liposomes into the cytoplasm (11). In such cases the liposomes must have a negative charge and contain predominantly unsaturated fatty acids.

There are two possible ways in which the enzymes incorporated in liposomes may interact with the substrate. In the first case the enzyme released from a liposome acts on the substrate located next to it; in the second the corresponding substrates (probably with low molecular weight) penetrate the phospholipid layers and are broken down by the enzyme in a water medium (11).

An important step in the problem of treating hereditary enzymeopathies is the development of standard methods for obtaining liposomes which would be nontoxic and which would not provoke allergic reactions. In order to obtain liposomes Desnick et al. (14) used a mixture of cholesterol, lecithin and phosphatidic acids in a 7:2:1 molecular ratio. Beta-glucuronidase was incorporated into the liposomes; in *in vivo* experiments 70 percent of it was taken in by the liver where it was detected eight days after injection.

Davidenkova et al. (18) described a method for obtaining liposomes containing creatine phosphokinase. Incorporation of the enzyme in the liposomes depended on the presence in it of charged lipids, without which protein intake was insignificant. Phosphatidic acid was used as a negatively charged lipid; sterilamine, as a positive. The maximum intake of enzyme was observed at a sterilamine content of as much as 15 mole percent and a phosphatidic acid content of as much as 10 mole percent. The liposomes were subjected to the action of ultrasound for 1 min. The liposomes obtained in this manner had no toxic effect on the culture of lymphocytes and also did not provoke general reactions when administered internally.

Side reactions were noted when the liposomes were contaminated with isoleucine or phosphatidylethanolamine (19).

Apart from incorporation of enzymes in liposomes attempts have been made to encapsulate them in erythrocytes (14, 18). Mouse erythrocytes were used for

incorporation into them of beta-glucuronidases (14). Bound enzyme was isolated from free enzyme using chromatography on sefaroz 6B. The fate of internally administered free and incapsulated enzymes was followed. Although the maximum activity of both forms of the enzyme was identical, the bound enzyme remained five times longer in the liver than the native enzyme. This indicates that the enzyme incorporated into an erythrocyte is less susceptible to intracellular proteolytic break-down.

The conditions for maximum incorporation of creatine phosphokinase in human erythrocytes have been worked out: the concentration of the enzyme, the time of hypotonic treatment of the erythrocytes in order to form pores and the optimal number of erythrocytes for enzyme intake have been selected. The latent activity of creatine phosphokinase in the erythrocytes persists for three days (18).

At present experimental and clinical investigations are being conducted on the use of enzymes containing lysosomes in hereditary lysosomal diseases, particularly in storage diseases (20, 21). The possibility of the penetration of exogenous enzymes into lysosomes and the manifestation of its specific effect there has been studied (22).

The effectiveness of the therapeutic action of microcapsulated catalases in hereditary enzyme deficiency in mice has been demonstrated (23). With intraperitoneal injection of the enzyme the catalase level is restored and immune and hypersensitive reactions do not arise. The use of liposomes containing glucocerebrosidase in Gaucher's disease, which is caused by a deficiency of this enzyme (11). In this disease glucocerebrosides accumulate in phagocytizing mononuclear cells, and Gaucher cells are formed. The administration of the enzyme has a positive therapeutic effect.

The use of immobilized enzymes in therapy for pyo-inflammatory processes by local injection is an urgent problem. By diluting the viscous secretions and necrotic masses, the enzymes facilitate more rapid removal of them, promoting the action of medicinal substances on the pathogenic microflora and also lower the resistance of different microflora to antibiotics.

The creation of enzyme preparations capable of remaining for a long time at the site of pathology is an urgent task of local enzyme therapy. To a significant degree these requirements are satisfied by immobilized enzymes.

Preparations obtained both from animal tissues and from microorganisms are used in the treatment of many diseases. Proteinase complexes are isolated from *Aspergillus terricola* (territilin, gigrolitin) and their immobilized forms obtained in our country. The latter are characterized by weak antigenic properties, weaker sensitivity to blood inhibitors and a positive therapeutic effect in experiments on animals (24). The stability of territilin immobilized on watersoluble polymeric matrices based on vinylpyrrolidone or dextran increases and its toxicity decreases significantly (25). Such an enzyme is four times more resistant to serum inhibitors of proteases than the native form (26).

A wider and more challenging field of use for immobilized enzymes is parenteral enzyme therapy. At present in clinical practice administration of highly purified enzymes intravenously or intramuscularly is possible in cases when it is necessary to increase the concentration of them in the blood, lymph or extracellular fluid.

The use of enzymes and their immobilized forms in treating thromboses has a special place among the problems of parenteral enzyme therapy (6, 27, 28). There are two possibilities for enzyme dissolution of thromboses. The first is injection of active plasmin into the vascular bed; the second is intravenous infusion of substances capable of causing the transformation of the endogenous plasminogen in the blood into plasmin (28). It has been demonstrated that use of plasmin in combination with heparin has a positive effect in treating peripheral thromboses of the blood vessels (7). A number of authors, however, have not observed thrombolytic action by plasmin in vivo, a finding which is associated with the presence in the plasma of excess quantities of antiplasmin, in association with which the enzyme does not hydrolyze fibrin (29, 30, 31).

It is more advisable to use activators of fibrinolysis which directly or indirectly promote the transformation of the plasminogen in the clot of fibrin into the active fibrinolytic enzyme of blood--plasmin (29).

It is significant that fibrinous blood clots absorb and strongly maintain plasminogen and its activator (28, 32). The antiactivator of plasminogen and the inhibitors of plasmin in the fluid fraction of blood do not impede the reaction of lysis of the clot (33).

Among the activators of plasminogen the most studied is streptokinase, obtained from beta-hemolytic streptococci, the therapeutic effectiveness of which in treating thromboses, myocardial infarcts and pulmonary embolism has been demonstrated (28, 30, 31, 34). The antigenic properties of streptokinase, however, and the necessity of preliminary determination of the titer of antistreptokinase limit its clinical application. Another, more physiological activator of fibrinolysis, urokinase, which has an undoubted effect on thrombo-embolytic conditions, was isolated from human urine (28, 35, 36). Its wide use in clinical practice is prevented by the difficulty of isolating it in sufficient quantities (37).

The feasibility of using immobilized thrombolytic substances is being investigated at present in connection with the indicated drawbacks of native fibrinolytic agents. Change (38) developed a method of microcapsulating streptokinase in granules with multipermeable walls. Intravenous injection of microcapsulized streptokinase is not very promising, however, inasmuch as fibrin molecules are not capable of penetrating the capsule. Moreover, with this kind of administration it is evenly distributed throughout the organism with the result that it is not possible to attain the necessary concentration of the enzyme in the thrombosed vessel. Still another negative feature of this preparation is the fact that the coating of the capsule, which is a polyamide, cannot be transformed in the organism (10) and be eliminated by the time the treatment is terminated.

At present attempts are being made in our country to obtain immobilized fibrinolytic enzymes on biocompatible carriers which would be equally hydrolyzed and eliminated from the organism. Torchilin et al. (39) immobilized streptokinase on sefadex, which is a derivative of biocompatible dextran, used as a plasma-replacement solution (the Soviet preparations of it are called poliglyukin and rheopolygludin) after preliminary oxidation with periodate. The solubility of a preparation of immobilized streptokinase depends on the degree of oxidation of the sefadex, i.e., on the number of aldehyde groups on the carrier, a fact which makes it possible to obtain a modified enzyme with the desired time of solution. It is hypothesized that streptokinase gradually goes into solution with fragments of the carrier and has high activity and stability. Torchilin (40) achieved immobilization of alpha-chymotrypsin on natural anticoagulant--heparin. The preparation has higher than usual resistance to thermal inactivation and practically completely retains its catalytic activity.

The problem of creating thrombolytic materials in making prosthetics for blood vessels is closely related to enzyme therapy of thromboses (9). As is well known, the process of thrombosis formation is activated as the result of direct contact of the blood with heterologous material. In order to avoid this occurrence the surface of the vessels is covered with enzymes with proteolytic action.

The use of proteolytic enzymes is also promising in oncology. Interest in enzyme therapy for malignant neoplasms as a variety of chemotherapy originated a long time ago, but only in recent years has it received significant development. Attempts to use proteolytic enzymes, nucleases and mucopolysaccharidases for the purpose of a direct destructive action tumor tissue have been made. (41). Another, more promising field of the enzyme therapy of tumors began to develop thanks to demonstration of the properties of the metabolic processes in cancer cells, particularly the discovery of the disturbance in amino acid metabolism in malignant tumors. It proved to be the case that some populations of cancer cells are characterized by a parasitic type of amino acid metabolism associated with a deficiency in the enzyme-synthesizing system. With certain lymphoblastic forms of leucosis the populations of lymphocytes do not contain asparagine synthetase, which synthesizes asparagine, which is necessary for protein synthesis (6). And naturally, if the pathway of asparagine intake to such defective cells were cut off, they would die. This fact served as the basis for using asparaginase for therapeutic purposes. This is the enzyme which hydrolyzes asparagine and thus decreases its concentration in the blood circulation and the tumor cells.

The high antitumoral activity of asparaginase has been shown in experiments on animals and in clinical practice (42, 43).

The enzyme is most effective in treating lymphoblastic leucoses in children, less so in treating other forms of leucoses, particularly myeloblastic leucoses. Still, the side reactions, the toxic effect of the preparations on the liver and other organs and its rapid destruction in the blood flow

under the action of tissue proteases prevents wide application of asparaginase in oncology. In order to overcome immunological incompatibility and to increase the stability of the enzyme, attempts are being made to obtain and study the effectiveness of immobilized asparaginase covalently bound with a carrier which does not have a toxic or carcinogenic effect.

In testing preparations of immobilized asparaginase on animals two methods of administering them are used (44): using microcapsulized forms or small granules of the carrier and the enzyme reactor through which the patient's blood is passed (the principle of hemodialysis).

Injection of asparaginase into the blood of mice results in a decrease in the concentration of asparagine to zero in as little as one hour (44). The time of half-disintegration of the immobilized enzyme is equal to 60-72 hr; of free enzyme, two hr. Intraperitoneal administration to rats of asparaginase incorporated in a polyacrylamide gel is accompanied by a practically complete decrease in the concentration of asparagine in one day. On the fifth-eighth day, however, the asparagine content increases to 40-80 percent of the initial level, a result which apparently is explained by the formation on the surface of the granule of fibrous precipitates which impedes the interaction of the enzyme with asparagine.

According to Hersh's data (45) when asparaginase immobilized on polymethylmetacrylate is injected into human blood the asparagine content decreases to zero, and the activity of the enzyme reaches its maximum two hours after infusion.

The feasibility of administering the enzyme by implantation of a vascular prosthesis covered with asparaginase and heparin has also been investigated in experiments on animals. In this case the asparagine content of the blood decreased briefly: on the fourth-fifth day it was significantly higher than usual.

More encouraging results have been obtained using asparaginase reactors located outside the organism through which human and animal blood was passed (44). The asparagine in the blood was completely hydrolyzed by the immobilized enzyme in two hours. The heparinization of the blood prevents the formation of clots of fibrin on the flakes of reactor. Collagen-asparaginase complexes which prevented the formation of fibrous films on them are used as carriers with high biological compatibility. Such enzyme-collagenous complexes and liposomes are probably the most promising for application in oncology.

Immobilized nucleases may be used in clinical oncology. Kurinenko et al. (46) studied the antitumoral activity of *Ser. marcescens* nucleases immobilized on soluble dextran. Intraperitoneal injection of the enzyme inhibits the growth of tumors; this is indicated by the 60-90 percent decrease in the number of tumor cells in ascitic fluid. The immobilized enzyme probably retains its catalytic activity longer than the native enzyme. In intramuscular injection the effect is less pronounced, a fact which is apparently explained by its binding with proteins at the injection site.

Along with immobilized enzymes the use of the inhibitors of proteolytic enzymes modified by polysaccharide carriers is promising. A method of obtaining the inhibitor of trypsin covalently bound with carboxymethyl-dextran has been developed (47). The modified inhibitor has higher than usual thermal stability in physiological conditions and retains about 70 percent activity. The bound inhibitor persists ten times longer in the blood vessel than free inhibitor, a fact which is significant for its prolonged therapeutic action (47). All this makes it possible to decrease the dose and the frequency of administration. In experiments on dogs the effectiveness of the immobilized inhibitor of trypsin in experimental pancreatitis has been shown.

The use of immobilized enzymes for removing toxic products, which often lead to uremia, from the blood in disorders of the kidneys is a promising field. For this purpose a switch is being made from the complex method of ridding the blood from toxic metabolic products using hemodialysis to purifying the blood by passing it through a column with microcapsulized urease (9). The excess urea is hydrolyzed by the bound enzyme, and the ammonia which ~~forms~~ is adsorbed by the microcapsulized adsorbant.

A no less important aspect of the application of immobilized enzymes in medicine is clinical diagnostics. In this case the enzymes are used as specific reagents in order to detect a number substrates and metabolic products in the biological fluids. The high sensitivity of the enzymatic methods in determining the content of glucose (48), urea (49) and ethyl alcohol (10) using glucoseoxidase, urease and alcoholdehydrogenase, respectively, is noteworthy.

Modified enzymes are already finding application in clinical and laboratory practice. Updike and Hicks (48) created one of the first automatic systems for determining the glucose content using immobilized glucoseoxidase. The fluid being analyzed was passed through a column containing modified enzyme (glucoseoxidase incorporated in polyacrylamide gel). The concentration of the resulting product of the reaction--hydrogen peroxide--was determined after addition of the corresponding reactives using a continuous-action colorimeter. Co-immobilized enzymes--glucoseoxidase and catalase--were also used for detecting glucose in the blood (50).

Automatic systems for determining the content of amino acid, metabolic products --urea, uric and pyruvic acids--and specific enzyme inhibitors in solutions have been developed. Thus alpha-amino acid oxidase immobilized on polysaccharides has been successfully used for determining the content of alanine, phenylalanine, asparaginic acid, isoleucine and methionine (51). Modified bacterial alkaline phosphatase is used on particles of porous quartz glass in order to detect and qualitatively determine inorganic phosphate (50).

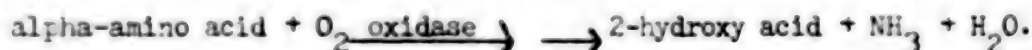
At present many reactors are manufactured which incorporate different immobilized enzymes intended for detection of certain substances. One of such systems is used in order to determine the content of salts of pyruvic acid and phosphoenopyruvic acids. In it lactate dehydrogenase and pyruvate kinase are immobilized separately on beads of hard glass and packed in individual columns.

A column with lactate dehydrogenase was used to detect salts of pyruvic acid; a column with both enzymes was used to detect salts of phosphoenolpyruvic acid.

Fresenius et al. (52) created many enzyme systems for quantitative determination of suchroses. The authors co-immobilized invertase, hexokinase, phosphohexoisomerase and glucose-6-phosphate dehydrogenase on agarose activated by cyanogen bromide.

Along with automatic systems with immobilized enzymes "areagent" enzyme electrodes are used for biochemical analyses. They are constructed on the principle of an electrochemical sensor to the sensory element of which a layer of immobilized enzyme is applied. Using them it is possible to determine quickly the concentration of some substance or another in biological fluids. Thus, Guilbault et al. (49) described a urease electrode for detecting urea. The authors immobilized the enzyme physically (by incorporation in polyacrylamide gel), then covered a cation glass electrode with a thin layer of it. When the electrode is immersed in the solution being analyzed which contains urea, the substrate diffuses in the layer of bound enzyme. Break-down of the urea into ammonia and carbon dioxide occurs. Subsequently ions of ammonium are recorded by the cation electrode, since the observed potential is proportional to the urea content in the sample.

This principle was successfully used by Guilbault et al. to determine alpha-amino acid content (53):



In order to detect glucose in the blood an enzyme electrode based on a platinum disc covered with a thin layer of glucose oxidase chemically bound with polyacrylamide gel is used. Under the action of the enzyme the glucose breaks down:



The resulting hydrogen peroxide oxidizes on the platinum electrode. The resulting current is proportional to the concentration of it and consequently to the initial concentration of glucose.

Recently enzyme-collagen membranes obtained by an electrochemical method (54) have been used for making enzyme electrodes. Such an enzyme electrode has been constructed for determining the content of saccharose. It consists of two membranes--an enzyme-collagen one and a teflon one which is capable of transmitting hydrogen. Invertase, mutarotase and glucose oxidase are co-immobilized on the collagen membrane. The double membrane is in direct contact with a platinum cathode. The control and experimental samples are identically saturated with soluble hydrogen before the determination.

As the result of the enzymatic reaction in the sample being investigated the quantity of hydrogen decreases, leading to a change in the current, on

the basis of which the saccharose concentration is evaluated. The authors believe that electrodes consisting of enzyme-collagen membranes have considerable advantages over those previously used and are more promising.

The data presented indicate the wide scope of research dealing with immobilized enzymes and examination of their biochemical and therapeutic properties. The majority of these preparations, however, are still at the stage of being tested on animals. A number of problems are arising which are associated with determination of the safety and the fate of the carrier when it is present in the organism for a long period of time and investigation of the feasibility of deliberate delivery of enzymes to certain tissues and cellular structures. It is to be hoped that the further investigations of the enzymologists, chemists and clinicists will open a real prospect of effective use of immobilized enzymes and their inhibitors for therapeutic and diagnostic purposes.

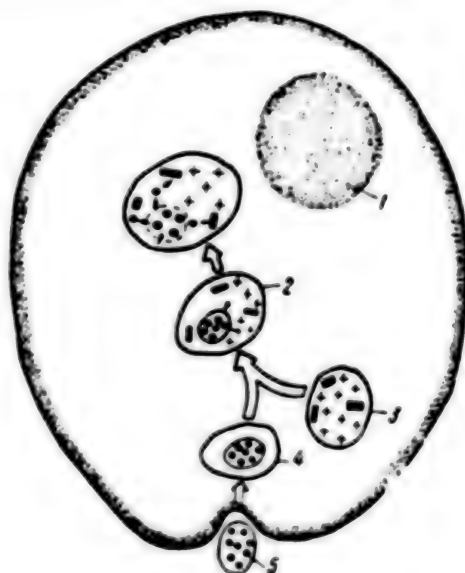


Figure. Schematic Drawing of Penetration of Liposomes into the Cell

Key:

- | | |
|-------------|-------------------------------|
| 1. nucleus | 4. vacuole |
| 2. fusion | 5. enzyme-containing liposome |
| 3. lysosome | |

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[12-9380]

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CONFERENCES

ANNUAL MEETING OF GENERAL BIOLOGY DEPARTMENT

Moscow ZHURNAL OBSHCHEY BIOLOGII in Russian No 4, 1979 pp 633-634

[Article by T.N. Shcherbinovskaya: "General Annual Meeting of the General Biology Department of the USSR Academy of Sciences"]

[Text] The general annual meeting of the General Biology Department of the USSR Academy of Sciences was held in Moscow on 13 March 1979. Academician-Secretary M.S. Gilyarov presented a report on the work of the department in 1978. In the year under consideration special attention was paid to problems of agricultural in connection with the tasks set by the July and November (1978) plenums of the CPSU Central Committee in the decisions of the General Meeting of the USSR Academy of Sciences "Science for Agriculture."

In 1978 investigations were completed on a number of major problems run by the General Biology Department that were of a certain theoretical and practical value. Problems of genetics and selection were successfully studied at all levels--from molecular to population. The speaker briefly described the results of work in the field of molecular genetics and genetic engineering, chemical and radiation mutagenesis, cytogenetics, population genetics and the genetic bases of plant and animal selection.

Researches on problems of biogeocenology and protection of nature were conducted in different zones of the country: in tundra, forest biogeocenoses, marshy forests and marshes of Karelia, in forest steppe, on chernozem-meadow soils and so on. Agrometeorological conditions were disclosed for the conducting of phytoreclamation work in the desert, and recommendations were made on the rational location of agrocenoses in the northeastern part of the country. Forest stands were found in Moscow Oblast which would provide the basis for the organization of a system of reserves.

In the field of study of biological bases of rational use and protection of the plant world, many valuable books were published or prepared for printing; compilation of the multivolume "Flora Yevropeyskoy chasti SSSR" [Flora of the European Part of the USSR] was completed. Research was expanded on the ultra-structure of plant cells and tissues, and a series of works on the study of lower and mosslike plants, on mycology, plant resources geobotanics and

protection of the plant world was completed. Much research has been conducted on the introduction and acclimatization of plants, valuable material has been collected on valuable and disappearing species, fast methods were proposed for assessing the winter hardiness of plants under conditions of the polar regions, work was expanded on the discovery and study of new species of plants that were promising for use in the national economy and also for purposes of horticulture and planting of trees and shrubs.

Much work was done on the development of the biological bases of acclimatization and protection of the animal world: "Krasnaya kniga SSSR" [Red Book of the USSR] on mammals, birds, reptiles and amphibians was compiled and prepared for publication. An ecological classification of soil saprophages was worked out with reference to their function in the working of organic substances. An ecological and physiological analysis was carried out on the population dynamics of the numbers of fish, a new ecological classification of adaptations of birds was developed, and identification guides for insects and ticks living in the soil were published. Theoretical substantiations were given for the use of juvenile-hormone analogs in the struggle against harmful insects and an attractant of the cotton borer. A patent was obtained for a vermicide preparation that is being effectively used against helminthic diseases of pigs.

Researches were conducted on problem of the individual development of animals at the molecular, subcellar, cellular, tissue and organismic levels. Interesting data were obtained on oocytes of loaches, DNA of ecaudate amphibians, on chick embryos and others. Indicators were determined for mitotic activity of mast cells in the early stages of differentiation determined on the basis of the ability to synthesize mycopolysaccharides. Results were summarized from the introduction of a method of selection of mulberry-silkworm breeding cocoons.

A number of themes were completed on the problems of the historical development of animal and plant organisms. It was established that the rapid growth in the diversity of insects in the late Cretaceous and Paleocene periods is connected to the formation and stabilization of the Cainophyte. Acute impoverishment and replacement of the composition of the limnofauna in the middle Cretaceous is to be explained by the eutrofication of a water body under the action of leaf fall. Secondary enrichment of these fauna in the Oligocene-Miocene period are connected with the formation of biotypes of underwater growths. A taxonomic classification was worked out of locations of marine invertebrates. The procedure was revised of paleobiogeographic regionalization on the basis of areal genetic conception. Many valuable reference works have been published.

Much attention was paid to the development of problems of hydrobiology, ichthyology and utilization of the biological resources of water bodies. As the result of conducted researches recommendations were provided for raising the fish productivity of water bodies; theoretical bases were developed for the creation of continual mass cultures of food plankton organisms, a method was proposed for the commercial cultivation of rotifer, an ecological-physiological method was developed for the analysis of the population dynamics of fish, plans were recommended for the arrangement of water catching structures

and fish diverting channels at locations of turns of rivers; conditions were determined for the reproduction of herbivorous fish in irrigation systems.

Considerable research was conducted on the forest problem. Bases were developed for the comprehensive use of cedar forests with demonstration of new principles of their economic evaluation. The water-conserving, water-regulating and soil-protecting role of these forests was demonstrated. A system of fellings in deciduous forests was recommended, and a new generalizing scheme of forest-management regionalization of Siberia. Principles of forest-fire regionalization of the country's State Forest Fund [Goslesfond] are being successfully introduced into production. Basic principles have been determined for the study of the postfire forest-forming process for an ecological evaluation of the consequences of forest fires.

Discussion of the report basically dealt with urgent problems of environmental protection. A.V. Yablokov pointed out the poor coordination of these important studies by different agencies, including the Academy of Sciences, and the need for working out a carefully planned scientific strategy in the field of protection of living nature. In the discussion, questions were raised concerning fish resources and their protection, in particular concerning sea fish management (A.V. Zhirmunskiy), concerning forest biogeocenoses and new forms of organization of scientific-research work in this field (N.I. P'yavchenko), concerning the development of a unified approach to problems of protection of the environment—including bodies of water, the atmosphere and vegetation (G.I. Galaziy), concerning the problem of anthropogenic factors, protection of animals and the necessity of a clear formulation of basic questions of environmental protection at the Academy of Sciences (L.V. Krushinskiy), concerning the preparation of necessary documents for the adoption of a law on protection of the animal world (V.Ye. Sokolov), on the influence of mutagens from the environment on the human organism (N.P. Dubinin) and on the need of creating a system of coordinated measures for the protection of the organic world (Ye.M. Lavrenko). In the discussion of the report, M.I. Popova, A.N. Studitskiy and others took part.

In his concluding remarks, M.S. Gilyarov noted that at the present time a program on ecology was being prepared and that in accordance with it a program should be prepared on the protection of nature, which would be of tremendous importance for the preservation of the ecological conditions surrounding man.

The general meeting adopted a decision approving the work of the Bureau of the General Biology Department in the fiscal year and also examined a number of organizational questions. It elected (by a secret vote) a director for the Laboratory of Forest Management of the USSR Academy of Sciences (S.V. Vomperskiy, doctor of biological sciences) and for a new term the directors of the Zoological Institute of the USSR Academy of Sciences (Skarlato, doctor of biological sciences), the Paleontology Institute of the USSR Academy of Sciences (Corresponding Member AS USSR L.P. Tatarinov), the Institute of Developmental Biology imeni N.K. Kol'tsov of the USSR Academy of Sciences (Corresponding Member AS USSR T.M. Turpayev), the Main Botanical Gardens of the

USSR Academy of Sciences (Academician N.V. Tsitsin), the Institute of Marine Biology of the Far Eastern Scientific Center of the USSR Academy of Sciences (Corresponding Member AS USSR A.V. Zhirmunskiy) and the Polar-Alpine Botanic Gardens-Institute of the Kola Affiliate of the USSR Academy of Sciences (T.A. Kozypeyeva, candidate of agricultural sciences).

At the general meeting, elections to the USSR Academy of Sciences were held. For the General Biology Department there were elected as corresponding members of the USSR Academy of Sciences: in the specialty of "ecology"--the director of the Institute of Plant and Animal Ecology of the Ural Scientific Center of the USSR Academy of Sciences, Doctor of Biological Sciences Vladimir Nikolayevich Bol'shakov, in the specialty of "plant introduction"--the president of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin, Academician of the Academy, Doctor of Agricultural Sciences, Professor Petr Petrovich Vavilov, in the specialty "genetics and selection"--the president of the Moldavian S.S.R. Academy of Sciences, Academician of that academy, Doctor of Biological Sciences, Professor Aleksandr Aleksandrovich Zhuchenko, in the specialty "invertebrate zoology"--the head of the laboratory of the Institute of Cytology of the USSR Academy of Sciences, Doctor of Biological Sciences, Professor, RSFSR Honored Worker in Sciences Yuriy Ivanovich Polyanskiy, in the specialty "genetics and selection"--the head of a department of the Institute of Chemical Physics of the USSR Academy of Sciences, Doctor of Biological Sciences, Professor Iosif Abramovich Rapoport, in the specialty "hydroecology"--the head of the Department of Zoology and Parasitology of the BSSR Academy of Sciences, Corresponding Member AS BSSR, Doctor of Biological Sciences, BSSR Honored Worker in Sciences Leonid Mikhaylovich Sushchenya, in the specialty "developmental biology"--the deputy director of the Institute of Developmental Biology imeni N.K. Kol'tsov of the USSR Academy of Sciences, Doctor of Biological Sciences, Professor Nikolay Grigor'yevich Khrushchov and in the specialty "genetics"--the deputy director of the Institute of Cytology and Genetics of the Siberian Department of the USSR Academy of Sciences, Doctor of Biological Sciences Vladimir Konstantinovich Shumnyy.

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UDC 633.11;575.1:664.6/7

GENETICS OF GRAIN QUALITY TRAITS IN TRITICUM AESTIVUM L.

Moscow GENETIKA in Russian Vol 15, No 7, Jul 79 pp 1264-1272 manuscript received 5 Jun 78

BEBYAKIN, V. M., Scientific Research Institute of Agriculture of the Southeast, Saratov

[Abstract] Studies were conducted on the genetic regulation of grain quality traits of several varieties of winter and spring wheats (Atlas 66, Saratovskaya 29, Mironovskaya 808, Ukrainka, Purdue 4930-A-6-28-2-1, Red River 68). Studies on the winter wheats revealed polygenic inheritance of quality traits and strong genotype-environment interactions. Breeding and selection in the F_2 generation were found to be highly dependent on the factors which were used to evaluate the biological qualities of the grain and the technical qualities of the flour. Figures 2; references 23: 9 Russian, 14 Western.
[520-12172]

USSR

UDC 576.312.32:633.11

EFFECTS OF THE ADDITION OF WHEATGRASS CHROMOSOMES ON WINTER HARDINESS OF WHEAT

Moscow GENETIKA in Russian Vol 15, No 7, Jul 79 pp 1285-1288 revised manuscript received 8 Jan 79

SINIGOVETS, M. YE., LAPCHENKO, G. D. and POMA, N. G., Scientific Research Institute of Agriculture of the Central Rayons of the Nonchernozem Zone, Moscow Oblast

[Abstract] Investigations were conducted on the effects of the addition of wheatgrass (*Agropyrum intermedium*) chromosomes to Saratovskaya 29 spring wheat on the frost hardiness of the resultant hybrids. Viability was tested following exposure to temperatures ranging from -6.5 to -12.5°C for up to 12 h, using hybrids with the $2n = 44$ genotype (Saratovskaya 29 $2n = 42$). In terms of increasing effectiveness, the wheatgrass chromosomes could be arranged in the following sequence: III > I > Ia > VII. In addition, chromosomes I and Ia also increased the resistance of the plants to mildew, and chromosome III potentiated resistance to leaf rust. Since none of these chromosomes compete with wheat chromosomes, it appears that wheat may be improved by chromosomal substitution by means of induced translocation or by cross over. Tables 2; references 10: 1 Western, 9 Russian.
[520-12172]

MONOSOMIC ANALYSIS OF LEAF RUST RESISTANCE IN COMMON SPRING WHEAT

Moscow GENETIKA in Russian No 6, 1979 pp 1067-1075 revised manuscript received 22 Jun 78

REYTER, B. G. and YEVDOKIMOV, M. G., Siberian Scientific Research Institute of Agriculture, Omsk

[Abstract] Studies were conducted on the genetics of leaf rust resistance in F_1 , F_2 , and F_3 hybrids obtained from a crossing of monosomal line of Chinese Spring (female) wheat with Hybrid 21 (male), using 2 clones of race 77 leaf rust agent designated as 77/P₉P₁₉ and 77/P₉P₁₉ (G 21). The results of the analysis showed that resistance of mature Hybrid 21 plants to the Siberian leaf rust agent is controlled by genes located on chromosomes 2A, 4A, 6A, 2B, 4B, 7B, and 2D. Monosomy in terms of chromosomes 2A, 2B, and 4B was responsible for resistant F_2 plants, while susceptibility in that generation was due to monosomal 4A, 6A, 7B, and 2D chromosomes. Resistance of germ plants against clone 77/P₉P₁₉ (G 21) is under the control of genes on chromosomes 2B, 3B, and 4B; resistance to clone 77/P₉P₁₉ was due to chromosomes 2A, 2B, 3B, 2D, and 3D. Chromosomes 2B and 2D appeared to be specific for resistance in the case of Hybrid 21, while chromosomes 2A, 3B, 4B, and 3D had leaf rust resistance function in both Hybrid 21 and Chinese Spring plants. Hybrids resulting from euploid and monosomal crossings demonstrated intermediate type of resistance vis-a-vis parental forms and, consequently, gene specificity was not evident in the F_2 generation. Therefore, genetic analysis for monosomic resistance against leaf rust needs to be conducted on F_1 , F_2 , and F_3 plants and not limited to the F_2 generation. References 24: 7 Russian, 17 Western. [523-12172]

EFFECTIVENESS OF A THERMOSTABLE EXOTOXIN AGAINST BROWN-TAILED AND PINE MOTHS CATERPILLARS IN THE WESTERN PAMIR

Dushanbe IZVESTIYA AKADEMII NAUK TADZHIKSKOY SSR in Russian No 1, 1979 pp 109-111 manuscript received 21 Aug 78

BULBULASHOYEV, T., Pamir Biological Institute Tadzhik SSR Academy of Sciences

[Abstract] Laboratory and field trials were conducted on the effectiveness of 0.1, 1.0, and 10% culture fluids of *Bac. thuringiensis*, known to contain

a thermostable exotoxin, in killing caterpillars of the brown-tailed moth and the apple tree ermine moth planted on apple trees in the Western Pamirs. The results showed that spraying individual affected branches with a 10% solution resulted in death rates approaching 100% for both species over the protracted period of 15-20 days. Less concentrated solutions were far less effective. Spraying entire trees (10-15 years old) was shown to be less effective on the basis of mortality rates of ca. 44% for the brown-tailed moth and 71% for the ermine moth after 10 days. In general, it appears that the preparations of the exotoxin against the moths tested in this study were relatively ineffective, and that the use of such preparations should be limited to the role of an adjunct to bacterial preparations. References: 4 Russian.

[929-12172]

USSR

COMPUTERS IN THE SERVICE OF MARRIAGE AND FAMILY COUNSELING IN THE SOVIET UNION

Moscow TEKNIKA MOLODEZHI in Russian No 7, 1979 pp 42-47

[Abstract] At a round-table discussion organized by TEKNIKA MOLODEZHI a number of marriage and family counseling experts and sociologists and psychologists exchanged their professional experiences and considered the applicability of computers in this field. The use of computers was thought by most participants to be necessary in view of the exacerbated demographic patterns such as the increase in the proportion of unmarried people and in the number of divorces and the fact that each year the number of fatherless family households increases by 350,000-400,000, all of which is holding back natural population increase. Urbanization and increasing individualization also are producing changes in family life, along with the emergence of the nuclear family. Computers can be used to provide match-making services, and such services should be introduced and popularized in the Soviet Union. In Czechoslovakia, 6,000 marriages annually are contracted thanks to the matchmaking services of Soviet-built computers, and this experience should be introduced in the USSR. A so-called cybernometer for measuring mutual compatibility has been developed by students at the University of Leningrad. In December 1977 the State Committee on Science and Technology under the USSR Council of Ministers resolved to organize a working group for drafting proposals for the organization of family counseling service in the USSR. A matchmaking service is being introduced as an irreducible minimum program. Next to come is the establishment of a comprehensive family counseling service.

[548-1386]

USSR

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ORGANIZATIONAL SYSTEM MANAGEMENT WITH CONSIDERATION OF THE HUMAN FACTOR

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 6, 1979 pp 122-133

manuscript received 29 Sep 78

BURKOV, V. N., IVANOVSKIY, A. G. and KONDRAT'YEV, V. V.

[Abstract] Attempts to develop a theory of organizational systems face a number of problems, including goal oriented functioning of the subsystems due to the presence of human factor. Recent studies in this area have been reviewed in this paper. Progress has been made in studies of dual level organizational systems consisting of a center (directing element) and

elements subjected to it. The model of such a system must consider the hierarchy of subordination in terms of natural and financial indices, their interrelationship and limitations. Analysis and synthesis of the functioning mechanisms is performed by theoretical gaming concepts, the game being played between the center and the active elements. New trends in this field include studies on widening the hypothesis of center information acquisition, the degree of centralization of functioning mechanisms in active systems, active systems with dependent elements and adaptive management network, iterative management networks in active systems, dynamic models and the use of aggregate plans and models in multilevel active systems. Several practical examples have been cited. References 50: all Russian authors in Russian (45), Polish (4) and English (1) language. [521-7813]

USSR

UDC 547.96.02+543.544

METHODS FOR INCREASING THE SENSITIVITY OF THE MANUAL EDMAN DANSYL METHOD

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 485-491
manuscript received 21 Aug 78

GANKINA, E. S., KOROLEVA, YE. M. and BELEN'KIY, B. G., Institute of High Molecular Weight Compounds, USSR Academy of Sciences, Leningrad

[Abstract] In published methods the sensitivity of identification of DNS-amino acids using thin film chromatography (TFS) has been 10^{-11} moles. A procedure has been developed to increase sensitivity of the assay procedure and includes high purification of reagents, decreasing volumes of reagents used, silanizing of reaction vessels, use of two dansylations (three dansylations are not needed to increase sensitivity) and use of a very sensitive photography of chromatograms developed. Details are given. Sensitivity was 10^{-9} moles. The Institute of Bioorganic Chemistry has approved the procedure. Figures 2; references 8: 3 Russian, 5 Western.

USSR

UDC 547.917'484'85'55'65/5

SYNTHESIS OF ALKYL 3-DEOXYALDULOSONATES BY CLEAVAGE OF SUGAR TETRA-CARBONYL DERIVATIVES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 578-582
manuscript received 25 Jun 78

ZHDANOV, YU. A. and KORNILOV, V. I., Department of Chemistry of Natural and High Molecular Compounds, Rostov-on-Don State University and PAYDAK, V. V., Scientific Research Institute of Physical and Organic Chemistry, Rostov-on-Don State University

[Abstract] Esters of dinitrodicarboxylic acids are the sources of 3-deoxyaldulosonic acids synthesized by the condensation of monosaccharide al-forms with ethylpyroacetate, the reduction of the dinitro derivatives into dioximes, and ester cleavage. Since it is impossible to directly convert the nitro derivatives into keto esters, they are converted into oximes. The use of lead tetra-acetate resulted in a 50-50% yield of keto-esters. Their structure was verified by spectroscopy and ^1H NMR. Alpha-ketoesters had a pronounced absorption band at 1750 cm^{-1} , and a weaker one at 1640 cm^{-1} (C=C bond). The last stage, that of ester cleavage was conducted at 0 degrees. At optimal duration of 2.5-3 hours, acid output is 30%, over longer durations the destructive influence of alkalis reduces output somewhat. The structure was confirmed by spectroscopy; there was

a strong absorption band at 1725 cm^{-1} , and a weak one at 1650 , as well as a blurred one at 3400 . Figures 1; references 6: 2 Russian, 4 Western.
[416-11574]

USSR

UDC 574.458.02+543:42.23

^{13}C NMR SPECTRUM OF SHIGELLA DYSENTERIAE TYPE 10 SPECIFIC POLYSACCHARIDE

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 583-587
manuscript received 28 Sep 78

SHASHKOV, A. S., DMITRIYEV, B. A., KNIREL', YU. A., SHERETEV, O. K. and KOCHETKOV, N. K., Institute of Organic Chemistry imeni N. D. Zelinskiy, USSR Academy of Sciences, Moscow

[Abstract] Because of substantial differences in alpha effects of O-glycosis and O-methylation, it is difficult to properly interpretate signals from carbon atoms participating in formation of the glycoside bonds. Oligomer models do not have this problem. Selective cleavage of glycoside bonds creates the basis for determining the structure of polysaccharides, using ^{13}C NMR. The ^{13}C NMR spectra of Shigella dysenteriae type 10 specific polysaccharides, and oligosaccharide fragments resulting from two Smith's degradations, were examined. The results of other methods are confirmed, viz., confirmation of the structure of the repeating unit of the specific polysaccharide. Any other interpretation is eliminated. This holds for the configuration of glycoside bonds and the replacement of monosaccharide residues. Figures 1; references 7: 3 Russian, 4 Western.
[416-11574]

USSR

UDC 547.953.2'672.07

SYNTHESIS OF NEW FLUORESCENCE LABELED PHOSPHATIDYL CHOLINES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 588-594
manuscript received 20 Oct 78

MOLOYKORDKIY, YUL. G., DMITRIYEV, P. I., NIKULINA, L. F. and BERGEL'SON, L. D., Institute of Bioorganic Chemistry imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow

[Abstract] Fluorescent probes which have been used to examine the structure of biological and artificial membranes may yield unreliable data on those structures, e.g., lateral diffusion of components in the lipid

bilayer. This shortcoming can be corrected by introduction of fluorescent markers into the phospholipid molecule; work in this area (Stoffel and Michaelis, 1974) has yielded useful anthryl derivatives. The anthryl radicals have the advantage of high stability and low polarity. Two such acids - N-(9-anthroyl)-11-aminoundecanoic and 12-(9-anthroyl)-11 trans-dodecenoic, were synthesized. The imidazole method was used for the latter because of its simplicity. Both acids exhibit intensive fluorescence, with maximums in the 400-450 nm range. Differences in emission spectra may be due to rotation around C-C bonds. In contrast to most fluorophores, these acids exhibited more intensity in polarized solutions. Figures 2; references 16: 2 Russian, 14 Western.

1979

FATTY ACID COMPOSITION OF MITOCHONDRIAL LIPIDS OF PLANTS GROWN UNDER VARIABLE CONDITIONS OF GRAVITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 246, No 5, 1979 pp 1253-1255 manuscript received 1 Feb 79

TAIBERMAN, M. G., YELFIMOVA, I. A., and TSYBENDAMBAYEV, V. D., Institute of Medical Biological Problems, Moscow

[Abstract] The composition of fatty acids of mitochondrial lipids was investigated as an adaptive response of 3 day old corn germ plants to variable conditions of gravity. Experimentally, one group of plants was maintained for 72 h in the dark at 25°C on the horizontal axis of a clinostat rotating at 10 rpm (simulating 'partial' weightlessness), while another group was centrifuged at 87 rpm (=2g) under otherwise identical conditions. Subsequent analysis demonstrated that total concentrations of mitochondrial lipids in the clinostat, control, and centrifuge plants were, respectively, 0.1, 0.08, and 0.1 μ moles/mg protein, while the corresponding ratios of unsaturated to saturated fatty acids were 1.91, 1.67, and 1.54, respectively. The increase in the fraction of the unsaturated fatty acids in the clinostat experiment was interpreted to indicate an adaptive mechanism, since the levels of the unsaturated fatty acids have been shown to correlate directly to the reversibility of mitochondrial swelling and contraction. Excessive gravity (2g) apparently overcame the adaptive capabilities of the plants under study. The major fatty acids detected were palmitic, stearic, oleic, linoleic, and linolenic. Tables 1; references 10: 4 Western, 6 Russian.

[535-12172]

BACTERIOPHAGE T₄, RNA LIGASE, I. PURIFICATION, ENZYME ASSAY, DIMER FORM

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 621-627
manuscript received 1 Aug 78, after revision 2 Oct 78

VASILENKO, S. K., VEN'YAMINOVA, A. G. and YAMKOVY, V. I., Novosibirsk State Univ. and MAYOROV, V. I., Special Design and Technology Office of Biologically-Active Compounds, Novosibirsk

[Abstract] RNA Ligase extracted from *E. coli* B infected by T₄am82 was purified of nuclease by a combination of traditional methods and isoelectric focusing in an inert medium - P-2 biogel. The first steps followed Weiss, et. al. (1968). The formation of the acid-insoluble / 8 ³H AMP-ligase complex reached equilibrium in 5 min. at 20 C. At 37 C, the plateau was reached in 1 min, but bonding was one half the former level. Differences in bonding might reflect pH or temperature dependence. A reduction of pH from 7.5 to 7 reduces bonding by 14%. Above 28 C, disassociation does not involve any enzyme. The multi-step purification procedure is outlined in a table. When the ammonia sulphate solvent is reduced to pH 5.5-6.0, during concentration in Sephadex G-100, the enzyme assumes a dimeric form. Figures 5; references 21: 5 Russian, 16 Western.

ENANTIOSELECTIVE HYDROLYSIS OF N-PHENACETYL-D, L-C-PHENYGLYCINE BY NATIVE AND IMMOBILIZED PENICILLINAMIDOHYDROLASE FROM *E. COLI*

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 604-610
manuscript received 25 Sep 78

YAMSKOV, I. A., BUDANOV, M. V., and DAVANKOV, V. A., Institute of Heteroorganic Compounds, USSR Academy of Sciences, Moscow and NYS, P. S., and SAVITSKAYA, YE. M., All-Union Scientific Research Institute of Antibiotics, Moscow

[Abstract] In order to study the enantioselectivity of racemic N-phenacetylphenylglycine hydrolysis by both native and immobilized forms of *E. coli* penicillinamidohydrolase, the enzyme was immobilized in polystyrol and silochrome. Three types of modified carriers were synthesized: I--porous gamma aminopropylsilochrome (0.7 mmole of aminogroup per 1 g carrier); II--porous n-aminoarylsilochrome (0.15 mmole/ g); III--isoporous and heteroporous n-aminopolystyrol (1.2 mmole aminogroup per 1 g). Azocoupling was used for II and III, and glutaric dialdehyde for I and III. Sorption is highest on silochromes (30% of covalent bound enzyme); it

does not exceed 5-10% for polystyroles. Ligand exchange chromatographic separation of reaction products verified the enantioselectivity. Tables present data on activity and characteristics of resulting products. For I and II the immobilized enzyme had maximum activity at pH 7.6 and the curves coincided with dissolved enzymes, while for III maximum was around 8.0. The immobilized enzyme activity dependence upon substrate concentration can be described by Michaelis-Menten equation. An anomalous relationship was observed for *n*-aminoarylsilochrome. Figures 4; references 16: 9 Russian, 7 Western.

[416-11574]

USSR

UDC 557.156.07

ASPERGILLOPEPSIN F-A CARBOXYLIC PROTEINASE FROM ASPERGILLUS FOETIDUS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 595-603
manuscript received 15 Sep 79

KOTELNITSKAYA, V. I., KOTLOVA, YE. K. and STEPANOV, V. M., All-Union Scientific Research Institute of Genetics and Selection of Industrial Microorganisms, Moscow and HUDENSKAYA, G. N., BARATOVA, L. A. and BELYANOVA, L. P., Chemistry Faculty, Moscow State University imeni M. V. Lomonosov

[Abstract] Pursuing previous work on *Aspergillus awamori*, a carboxylic proteinase, aspergillopepsin F, was isolated from enzymes produced by *Aspergillus foetidus*. Chromatography on aminosilochrom S-80 and affinity chromatography on bacitracin-Sepharose purified the enzyme. Akrilex P-10 was used, as the enzymes hydrolyzed sephadex. The enzyme hydrolyzes hemoglobin at an optimum pH of 2.5. Peak isoelectric point is at pH 4.07, at which point activity has increased by a factor of 1.7; this might be the point of low molecular inhibitor separation. In basic ranges the peak corresponds to a mixture which is not a protein; it is stable in the pH 2.5 - 6.0 range at 20 C and is inhibited by *N*-2,4-dinitrophenyl-*N'*-diazocetylhexamethylenediamine (99.6%) and pepstatin (100%). There are great similarities in the amino acid compositions of F and A. Proteinases from *Asp. saitoi* and *Asp. oryzae* are similar, although the latter differs in the content of lysine and alanine. This *Asp. F.* proteinase contains comparatively large amounts of lysine and very little arginine. Automated Edman procedure indicated no difference between Aspergillopepsin A from *Asp. awamori* with regard to the sequence of 41 amino acids in the N terminal portion of the enzyme. Segments 18, 19, and 26 have still not been identified. The similarity in structure is probably due to recent evolutionary divergence; *Asp. F.* was similar to penicillopepsin from *Penicillium janthinellum* and to swine pepsin. The *Asp* proteinases should

be considered a separate group of acid proteinases. Figures 5; references 22: 11 Russian, 11 Western.
[416-11574]

USSR

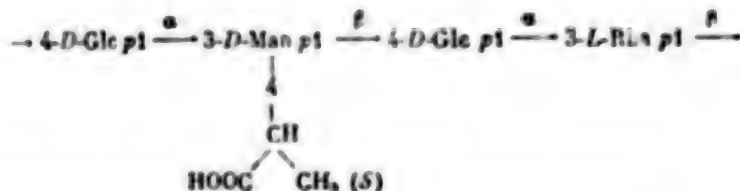
UDC 547.458.02+577.11

POLYSACCHARIDES OF MYCOBACTERIA. 4. STRUCTURE OF EXTRACELLULAR POLYSACCHARIDE FROM MYCOBACTERIUM ALBUM B-88

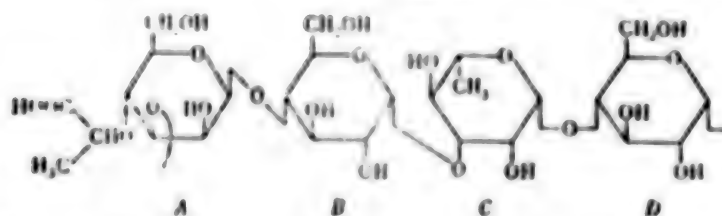
Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 568-577
manuscript received 11 Aug 78

SVIRIDOV, A. F., ARIFKHODZHAYEV, KH. A., SHASHKOV, A. S., BOTVINKO, I. V., CHIZHOV, O. S. and KOCHETKOV, N. K., Institute of Organic Chemistry imeni N. D. Zelinskiy, USSR AN, Moscow

[Abstract] A combination of methylation, partial acid hydrolysis, and oxidation with chromium trioxide and sodium periodate was used to determine the structure of extracellular polysaccharide from Mycobacterium album B-88. It is as follows:



The above procedures also indicate the following structure:



The use of ^{13}C NMR spectroscopy also confirms this structure. There are four signals having an integral intensity of 1:1:1:1; a single peak at 177.6, indicating a carbonyl group, A; peaks at 18.25, and 17.3 for methyl groups C and A. An unusually high shift at 95.8 indicates a replacement for the D-glucopyranose residues. No fragment of the polyols (XVII)-(XIX) contained a CH_3 group. This shift is not due to a lactone, and negative results for sulphur, and phosphate indicate that it requires further study. Figures 7, references 20: 6 Russian, 14 Western
[416-11574]

USSR

UDC 661.183.1+547.244+547.476.2+547.963.32

APPLICATION OF POLYMERS CONTAINING p-AMINOMETHYLPHENYLBORIC ACID GROUPS
FOR GEL-FILTRATION OF POLYNUCLEOTIDES AND FRACTIONATION OF ALDONIC ACIDS
AND NUCLEOSIDE POLYPHOSPHATES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 526-535
manuscript received 25 Jul 78, after revision 11 Oct 78

KOLODKINA, I. I., YEVSTIGNEYEVA, N. A., MAMONTOVA, T. A., GRUDNEVA, V. S.,
and YURKEVICH, A. M., All-Union Scientific Research Vitamin Institute,
Moscow

[Abstract] N-vinylpyrrolidone and N, N-dimethyl-N-(p-methylphenyldihydroxyboric)-aminoethylmethacrylate copolymer and adenosine and t-RNA were used as ligands to examine the formation of ion-exchange boron polymers with nucleosides and polynucleotides. Polymers containing N, N-dialkyl-N-(p-methylphenyldihydroxyboric) and other N, N- ionic exchange groups can attach firmly to ribonucleotides and oligoribonucleotides and extract them from mixtures containing 2' (3')-desoxynucleotides, and breakdown hydrocarbons containing cis-glycol groups. The method of pH measurements was used to study the formation and stability of cyclic complexes with phenylboric acid. Solutions of $MgCl_2$ increased the specificity of association between boron polymers and cis-diols containing t-RNA and adenosine polyphosphates. The acids remain attached to the polymers even in slightly acid conditions. This is partially due to additional ionic interaction. The greatest difference in phenylboric complex stability is in the pH 7.5-8.0 region. The difference in boron-polymer binding to adenosine and t-RNA might permit the use of DEAE-Sephadex A-25 in fractionating adenosine, ADP, ADP, and ATP, and a number of compounds containing cis-glycol and acid groups. Figures 4; references 21: 8 Russian, 13 Western.

[416-11574]

USSR

UDC 547.962.07

SYNTHESIS OF GASTRIN TERMINAL FRAGMENTS AND THEIR COUPLING TO PROTEINS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 4, Apr 79 pp 497-507
manuscript received 3 Aug 78, after revision 10 Oct 78

PRUSAKOV, A. N., SAMARTSEV, M. A. and MARTYNOV, V. F., Leningrad State University imeni A. A. Zhdanov

[Abstract] Peptides corresponding to the C and N terminal amino acid sequences of gastrin and their analogues were synthesized and joined to proteins. The resulting antigens were used to obtain antibodies and to

study immunological specificity to various gastrin forms and fragments. Seven peptides were synthesized. Acid secretion stimulation potency was decreased by the introduction of an additional ionic group into an active fragment. The resulting peptides were tested for physiological activity on dogs. The results agreed with Morley (1968). No peptides inhibited pentagastrin-stimulated secretion. The method using toluenediisocyanate activates albumin through an excess of bifunctional reagent; the method using 2,4-dinitro-1,5 difluorobenzene activates peptide amino groups. Except for the use of ovalbumin and human serum albumin, the remaining amino acid derivatives were obtained from L-series amino acids following described methodologies. Their characteristics corresponded to those described in the literature. The methodology for obtaining the 8 peptides (and the peptides themselves) is outlined in an experimental section. Figures 2; references 28: 2 Russian, 26 Western.
[416-11574]

USSR

UDC 577.158

CIRCADIAN RHYTHM IN THE ACTIVITY OF ORNITHINE DECARBOXYLASE AND ITS ENDOGENOUS HIGH MOLECULAR WEIGHT INHIBITOR IN THE RAT PINEAL GLAND

Moscow BIOKHIMIYA in Russian Vol 44, No 7, Jul 79 pp 1317-1320

ZARYGIN, K. N., TPUSHINA, YE. D. and ISACHENKOV, V. A., Department of Biochemistry, Central Scientific Research Laboratory, 4th Main Administration, USSR Ministry of Health, Moscow

[Abstract] Investigations were conducted on the circadian variability in the activity of ornithine decarboxylase (OD) of the rat pineal gland in relation to an OD inhibitor. Fractionation of a cytosol fraction on Sephadex G-100 columns in 250 mM NaCl led to separation of the enzyme and its inhibitor, a protein with a molecular weight of ca. 30,000 similar to a hepatic OD inhibitor. Peak OD activities were noted at 2400 h and lowest activities at 1200 h; the inverse relationship applied to the levels of OD inhibitor. It appears, therefore, that circadian fluctuations in OD activity in the pineal gland of male albino rats used in this study are due largely to circadian changes in the levels of the OD inhibitor, rather than to changes in the amount of enzyme actually present in the gland. Figures 2; references 14: 2 Russian, 12 Western.
[527-12172]

ANALYSIS OF THE KINETICS OF COMBINED INHIBITION OF CHOLINESTERASES

Moscow MOLEKULYARNAYA BIOLOGIYA in Russian No 4, 1979 pp 854-869 manuscript received 20 Sep 78

IONOV, S. P., GODOVIKOV, N. N., LYUBIMOV, V. S., MANAKOVA, L. A. and KABACHNIK, N. I., Institute of Hetero-Organic Compounds, USSR Academy of Sciences, Moscow

[Abstract] Comparative studies were conducted on the various possible kinetic approaches employed in evaluating combined inhibition of acetyl- and butyrylcholinesterases by organophosphorus inhibitors. The results showed that, within experimental errors, essentially identical inhibition constants were obtained in relation to concentrations employed. Further, on the basis of more than 200 experimentally derived points, a linear relationship was found to prevail between the logarithms of constants representing reversible and irreversible effects of the inhibitors on the cholinesterases. The available data appear to indicate that present methods of experimental analysis do not allow for estimation of the non-productive degree of inhibitor binding to active sites. Figures 1; references 19: 2 Western, 17 Russian.

[526-12172]

ASSIMILATION AND METABOLISM OF BENZIDINE BY HIGHER PLANTS UNDER STERILE CONDITIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 247, No 1, 1979 pp 244-247

DURMISHIDZE, S. V., academician, Georgian SSR, Academy of Sciences, DEHIKIYA, A. N. and LOMIDZE, E. P., Institute of Plant Biochemistry, Georgian SSR Academy of Sciences, Tbilisi

[Abstract] Investigations were undertaken on the uptake and metabolism of ^{14}C -labeled benzidine by 10-day old shoots of corn (*Adzhametis tetra* variety), peas (*Pobeditel'* variety) and beans (*Borzhomula* variety) grown under sterile conditions. Analysis of the resultant data demonstrated that benzidine is readily assimilated by these plants, and that its oxidative metabolism involves disruption of the aromatic ring with subsequent incorporation of the carbon atoms into common metabolites (organic acids,

amino acids), low molecular weight compounds, and biopolymers. References 15: 6 Western, 9 Russian.
[514-12172]

USSR

UDC 616.001.17 + 577.161.3

EFFECT OF VITAMIN E ON THE CONTENT OF THIOL GROUPS IN RATS AFTER BURN TRAUMA

Yerevan BIOLOGICHESKIY ZHURNAL ARMENII in Russian Vol 32, No 5, May 79
pp 393-396 manuscript received 12 Feb 79

AGADZHANOV, M. I., SEMERDZHYAN, L. V., and MKHITARYAN, V. G., Yerevan Medical Institute

[Abstract] Changes in the content of the total, non-protein and protein-bound sulfhydryl groups in brain, liver and blood at various times after exposure to burn trauma was studied in rats. The effect of alpha-tocopherol on this process was also investigated. The total thiol groups in the liver dropped by one third immediately after the burn, returning to normal levels after 7-15 days and even becoming somewhat elevated. Free SH groups behaved analogously. The behavior of sulfhydryl groups in brain, liver and in blood was similar. Analogous data were obtained from burned patients. It was established that intraperitoneal administration of alpha-tocopherol acetate to burned rats accelerated normalization of the endogenous SH groups in all tissues. References 20: 14 Russian, 6 Western.
[528-7813]

USSR

UDC 616.33-002.44-085.847.8

USE OF MAGNETOTHERAPY IN COMBINED TREATMENT OF ULCER PATIENTS

Kiev VRACHEBNOYE DELO in Russian No 7, Jul 79 pp 5-8

GUSEVA, N. G. and SHELYGINA, N. M., Section of Physiotherapy, Voroshilovgrad Oblast Clinical Hospital; Department of Hospital Therapy, Voroshilovgrad Medical Institute

[Abstract] Numerous Soviet authors are cited to show earlier successes in treatment with magnetic fields to achieve desirable analgesis, anti-inflammatory, trophic neurovegetative normalizing and central nervous inhibitory action. On that basis, use of a magnetic field was tried in treatment of duodenal ulcers in 137 patients of both sexes, ages 17 to 60, duration of disease one year to more than ten. A Polyus-1 magnetotherapy apparatus, developed by the All-Union Scientific Research Institute of Medical Instrument Building was employed; also used was a medical electromagnet constructed by one of the authors. Patients were exposed for 15-20 min for a total of 20 times, sinusoidal current, uninterrupted, magnetic intensity 200 and 250 gauss. Compared were two patient groups, each of which received drug therapy, and one of which was subject to the magnetic field exposure. Based on recovery of gastric motor function analysis, relief of pain, X-ray examination and hospitalization time required, the magnetic field exposure had positive results, with no undesirable side effects. References: 6 Russian. [616-8585]

USSR

UDC 612.014.44+612.015.3

SOME INDICES OF METABOLISM DURING ACTION OF VARIOUS KINDS OF RADIANT ENERGY ON THE BODY

Kiev VRACHEBNOYE DELO in Russian No 7, Jul 79 pp 98-101

YATSULA, G. S., docent, Department of Nutritional Hygiene, Kiev Institute for the Advanced Training of Physicians

[Abstract] Earlier Soviet work is cited on the combined action of UV, X-ray and lethal or sub-lethal gamma rays (Zhuk, 1958, 1960, Sviderskaya, 1960, 1965) and of radionuclides (I. I. Ivanov, 1956, Babenko, 1960, Vorontsov, 1971, Gabovich, 1972) plus UV, on animal bodies. The present work deals with the application of UV and various levels of ionizing radiation upon the rat. The UV was applied with a PRK-4 mercury quartz lamp for 2.5 min, dose 10.25 millicalories per sq cm, area 30 x 40 cm, at a distance of

50 cm from the spine. Time of UV irradiation up to 135 days. Ionizing radiation was applied with a uranyl nitrate plate preparation, 1 milliroentgen per hr, 0.000017 roentgen per min, distance 15 cm. Some animals were exposed to RUM-3 and RUM-11 X-ray apparatus. Combinations of doses applied are tabulated. Metabolic data consisted of body weight change (growth) gas exchange (Yatsula's apparatus, 1964) and mineral composition in organs and tissues (ash). Male white rats were used, initial condition is not described. High weight gains were recorded for animals which received the combined radiation; UV also had a favorable action on gas and mineral metabolism when used with ionizing radiation, as compared to use of ionizing radiation alone. References: 17 Russian.
[616-8586]

USSR

UDC 538.12:581.142.2:633.11

EFFECTS OF WEAK MAGNETIC FIELDS ON THE RATES OF GROWTH AND CELLULAR REPRODUCTION, AND DRY MASS OF PEAS

Kiev DOPROVIDI AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 6, 1979
pp 458-460 manuscript received 18 Dec 78

BOGIATINA, N. I., VERKIN, B. I., academician, UKR Academy of Sciences,
LITVYN, V. M. and NIKULINA, V. F., Physico-Technical Institute of Low
Temperatures

[Abstract] Pansons'kyy 77 peas were germinated and grown for 72 h under the influence of weak magnetic fields (2×10^{-4} to 1 oe) while shielded from the terrestrial magnetic field to determine the effects on the growth of roots and shoots, the mitotic index, and the dry biomass. Statistically significant elongation of the roots and shoots was observed under the influence of 0.3-0.4 oe and 5×10^{-3} oe fields, while inhibition was evident with a 2×10^{-2} oe field. The weight of dry biomass was unaffected by exposure to these weak magnetic fields, while a 0.3-0.5 oe field inhibited the mitotic index of the roots by more than a half. These findings were interpreted to indicate magnetic field induced changes in the circadian rhythm of cellular division, cellular elongation, and possible redistribution of cellular division between the root and the stem (shoot). Figures 4; references: 1 Russian.
[519-12172]

USSR

UDC 616-002.8:582.288.42

PRESENT DAY ECOLOGICAL PROBLEMS OF DEEP MYCOSES

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 226-229 manuscript received 1 Jun 78

VAL'KOV, B. G. and SUVOROV, V. S., Volgograd Scientific Research Institute of Plague Control

[Abstract] Coccidiosis was found, as such, for the first time in the USSR by A. N. Araviyskiy, in the Kuzbass, over 26 years ago. Later it has been reported in the major cities in the RSFSR, Ukr, Kazakh, Arm and Georgian SSRs, as well as in the Baltic area and Turkmenia. The authors believe the causative agents of deep mycoses are parasites, not always obligate types. Discussion of the infection touches upon the soil as a protective medium of the causative agents (from which they are derived in dust and food of rodents) potential development of infection foci, major penetration routes of the agents into the animal body, mechanisms of spread of the deep mycoses from an affected rodent to a healthy rodent. Attention is drawn to an earlier (1977) review of N. D. Shelkakov and V. M. Leshchenko, although the article did not give a sufficiently high estimate of the health hazard. P. N. Kashkin, of the Volgograd Sci-Res Institute of Plague Control is cited for work on source of infection, transmission, foci and ecological aspects; Valkov's work on survival of the agents in the environment, disinfection, and susceptibility of animals is highlighted. References 23: 14 Russian, 9 Western.
[614-8586]

USSR

UDC 577.4(086.5)

ETEKOS: AN EXPERIMENTAL ECOLOGIC SYSTEM

Moscow BIOLOGICHESKIYE NAUKI in Russian No 7, 1979 pp 95-99 manuscript received 3 Apr 78

ALEKSEYEV, V. V., GEORGIYEV, A. A., GORBATOV, YU. I., LYAMIN, M. YA., MAKSIMOV, V. N., SAPOZHNIKOV, V. V., SHINKAR, G. G. and SHIROKOVA, YE. L.
Chair of General Ecology and Hydrobiology, Moscow State University imeni M. V. Lomonosov

[Abstract] A schematic outline is presented for the design of a tank used to simulate aqueous ecosystems, designed as ETEKOS, which makes it possible to determine various physical parameters (vertical distribution of light and temperature, turbulence factors at various depths, etc.). Addition of biologic factors, e.g., algae, bacteria, allows for monitoring changes in the physical parameters in relation to numerical and metabolic changes

in the microbial populations and for mathematical modeling of the totality of such a system. The ETEKOS tank is illustrated. Scientists of the physics, biology and geology faculties of MSU collaborated on the creation of the tank which is located in the hydrophysics lab of the physics faculty. Figures 2; references: 5 Russian.
[525-12172]

USSR

UDC 599.742.1

STRAY AND FERAL DOGS IN THE VORONEZH OBLAST

Moscow BYULLETEN' MOSKOVSKOGO OBSHCHESTVA ISPYTATELEY PRIRODY in Russian Vol 4, Jul/Aug 79 pp 18-27 manuscript received 5 Jan 79

RYABOV, L. S.

[Abstract] A review is presented of the problem of stray and feral dogs in the Voronezh oblast that presently are found to inhabit 25 regions. Generally, the areas populated by the dogs are free of wolves; the recent increase in the population of the latter and their spread over 70% of the Voronezh Oblast has reduced the actual area populated by these dogs. Maintenance of an adequate wolf-population seems desirable and effective for the control of such dogs. The dog population seems to be divided into two ecologic groups: those that reside close to human habitation and frequent garbage dumps and animal disposal sites, and a smaller group living in forests that preys on deer, other mammals, and occasionally on livestock. References 16: 2 Western, 14 Russian.
[524-12172]

USSR

UDC 574.63(26)

SELF-PURIFICATION OF MARINE WATERS FROM HEAVY PETROLEUM FRACTIONS

Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian No 3, 1979 pp 42-45 manuscript received 3 Jan 79

MIRONOV, O. G. and GEORGA-KOPULOS, L. A., Institute of the Biology of Southern Seas, Ukrainian SSR Academy of Sciences, Sevastopol'

[Abstract] A 70-day experiment was conducted to evaluate the capacity of seawater to cleanse itself of, and to modify, clumps of heavy oil fractions thrown up on the southwestern shores of Crimea. Exposure of the clumps to a flow of seawater at 17-22°C for 70 days and their subsequent physico-chemical analysis revealed marked chemical changes consisting of tarring,

decrease in sulfur content, decrease in the concentration of normal and isoprenoid paraffins, and invasion of the clumps by various marine organisms. Figures 1; references 5: 1 Western, 4 Russian.
[534-12172]

USSR

UDC 576.8(26)

SANITARY AND MICROBIOLOGIC EVALUATION OF THE WATER BODIES IN THE NORTH-WESTERN BLACK SEA COASTAL AREA

Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian No 3, 1979 pp 18-24 manuscript received 1 Mar 78

MIKHAYLENKO, L. YE., and PTOMOV, A. S., Institute of Hydrobiology, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] Microbiologic studies were conducted on the waters of the Dneper reservoirs, outlets of the Dneper, Southern Bug, Dnester, and Danube Rivers, as well as of the Dneper-Bug and the Dnester estuaries and the northwestern regions bordering on the Black Sea. The results showed that, on the basis of the experience with the Dneper reservoirs, the initial years after a reservoir is constructed are marked by an increase in the microbial population which numbers million of cells per milliliter and, five to six years later, a sharp fall occurs in which the microbial population sinks to a level lower than that of the river prior to the construction of the reservoir. The latter changes were apparently due to the increase in salinity. These and other findings were also interpreted to indicate that redirection of the Danube waters into the Dneper is contraindicated. References 25: 1 Ukrainian, 1 Western, 23 Russian.
[534-12172]

USSR

UDC 576.809.26:663.18

SYNTHESIS OF ORGANIC ACIDS BY IMMOBILIZED PROPIONIC BACTERIA IN A FLOW SYSTEM AND POSSIBILITIES OF STABILIZING THIS PROCESS

Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol 15, No 4, Jul/Aug 79 pp 515-521 manuscript received 28 Sep 78

IORDAN, YE. P., IKONNIKOV, N. P., KOVRIZHNYKH, V. A. and VOROB'YEVA, L. I., Moscow State University

[Abstract] The goal of this study was to investigate the activity of *Propionibacterium Shermani* cells in synthesis of organic acids in a flow system, using a variety of carbon sources and extending the performance period of this biocatalyst. It was shown that *Pr. shermanii* cells immobilized on polyacrylamide gel synthesized propionic, acetic and pyruvic acids in a flow system. Glucose, sodium lactate and whey lactose were used as carbon sources, the best results being obtained with sodium lactate. Optimal reaction conditions consisted of pH 7.0, incubation temperature 42°C and the concentration of the biomass 1.75-2 g/10 ml of the polymerization mixture. Anerobic reaction conditions intensified the formation of organic acids. The catalyst could be reactivated in a column by periodic exposure to a nutrient medium containing all the components needed for optimal cell proliferation, thus prolonging its useful life time. Figures 3; references 14: 6 Russian, 8 Western.
[532-7813]

USSR

UDC 577.152.001.5

STUDY OF THE CELLOCONINGINE P10x ENZYME COMPLEX

Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol 15, No 4, Jul/Aug 79 pp 560-563 manuscript received 10 Jul 78

MUKHINA, T. N., KALUNYANTS, K. A., KOLCHEVA, R. A. and MANUSHINA, L. F., Moscow Technological Institute of Food Industry

[Abstract] Enzyme complex celloconingine P10x obtained by ethanol precipitation of the aqueous extract of a surface culture of *Trichoderma* species T was tested for its activity towards substrates isolated from barley. The preparation contained a rich cytolytic complex in combination with amylolytic and proteolytic activities. Varying the pH and temperature, optimal reaction conditions for the enzyme activity were evaluated. They were as follows: for total cytolytic and hemicellulase activity: pH 5.2-6.2, t 45-55°C; for endo- β -glucanase activity: pH 4.2-5.2, t 58-62°C; for proteolytic activity: pH 4.0-4.8, t 64-68°C and for amylolytic activity: pH 3.6-4.2, t 60-66°C. Figures 3; references: 7 Russian.
[532-7813]

CSO: 1840

USSR

UDC 613.693:358.431:616.8-009.3-073.96

TREMOMETRY AS A METHOD OF EVALUATING THE FUNCTIONAL STATE OF A PILOT'S NERVOUS SYSTEM

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 7, Jul 79 pp 50-52

KOL'TSOV, A. N., KUKUSHKIN, YU. A., VARPOLOMEYEV, V. A. and KOLYAGIN, V. YA.

[Abstract] Muscular tremor is widely used in studies of the physiology of work and sport. Tremometry is the registration of the vibrations of individual body elements in respect to each other, while registry of involuntary deviations from a dot or a line is called the coordinatometry. The dynamics of tremors was studied on pilots during flights of varying duration and complexity and on operators working under highly stressed conditions. Both contact and contact-free coordination meters were used, the latter appearing to be better units. When evaluating the emotional state of a pilot, one should analyze the high frequency vibration, and the area of disagreement should be used for indications of imminent fatigue. Summary index of tremor frequency was found to be non-prognostic and did not show emergence of fatigue. Pilots with minimal experience showed higher indices of coordinatometry than experienced fliers. Figure 1; no references.

[530-7813]

USSR

UDC 613.68:612.766.1.057:359

EFFICIENCY CRITERIA FOR SHIP SPECIALISTS

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 7, Jul 79 pp 53-55

SAPOV, I. A., SHCHEGOLEV, V. S. and APANASENKO, G. L.

[Abstract] One of the more complex problems of naval operations is the establishment of criteria for evaluating the efficiency of personnel and predicting its course for the duration of the cruise. To approach this problem in a quantitative way, normal performance of all functional systems of the human body were considered, in addition to onset of fatigue. Basically, four phases have been recognized in the dynamics of efficiency: work-in period, optimal efficiency, unstable efficiency and progressive deterioration. Fatigue enters somewhere between the optimal efficiency and total compensation. Between unstable efficiency and progressive deterioration one suffers "overfatigue". Qualitative signs and quantitative indices can be developed for each phase. Finally, one can develop a formula which, using these quantitative measures, could provide a numerical value for determining the efficiency of personnel. Comparison of these values prior to and after a cruise could serve as an index of normal occupational performance. References: 4 Russian.

[530-7813]

Mg^{2+} -DEPENDENT ADENOSINETRIPHOSPHATASE FROM STREPTOCOCCUS FAECALIS
BACTERIAL MEMBRANES. II. STUDY OF THE H^+ -ATPase CATALYTIC MOIETY

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 5, No 4, 1979 pp 611-620
manuscript received 16 Aug 78

BABAKOV, A. V., GAVRILOVA, YE. G., GEVONDYAN, N. M., POLISHCHUK, G. I.,
TEREKHOV, O. P. and USMANOVA, R. G., Institute of Bioorganic Chemistry
imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow

[Abstract] Babakov, et al. earlier described (1979) a method to separate Mg^{2+} -dependent H^+ -ATPase from *S. faecalis* bacteria membranes and indicated its subunit structural makeup. Extension of that work is described here. Factor SfF_1 , the catalytic moiety of the H^+ -ATPase, was obtained by preparation of bacterial membrane fragments followed by solubilization of the membrane SfF_1 factor; the method employed here was that of Abrams (1969), modified to produce membrane fragments directly by cell lysis and use of continuous centrifugation at the solubilization stage. A homogeneous SfF_1 factor was obtained by carefully-controlled fractionation on Sephadex A-25 which permitted simultaneous use of the ion-exchange properties of that resin. Electrophoresis in polyacrylamide gel showed that the isolated moiety was homogeneous and was composed of four subunits. Measurement of the enzyme system conforms to Michaelis-Menten kinetics, wherein ADP is a competitive inhibitor of the ATPase. Maximum enzyme activity of the SfF_1 factor was seen when the ratio of $[ATP]$ to $[Mg^{2+}]$ was 2:1, at pH 7.8. The SfF_1 had a molecular weight (sedimentation equilibrium procedure) of 360,000; specific partial volume, 0.74; aminoacid composition, as tabulated; isoelectric point pH 4-5. Four subunits of SfF_1 , alpha, beta, gamma and epsilon, were isolated, in sodium dodecylate solution, by chromatography on hydroxylapatite and electrophoresis in polyacrylamide gel. All subunits (as is factor SfF_1) are acid proteins, with approximately the same percentage of non-polar aminoacids; cystein residues are in the alpha and beta subunits only. The active center of the enzyme appears to be the beta subunit; the alpha subunit is the center of attachment of adenine nucleotides. MWs of the subunits (per relative mobility in polyacrylamide gel in the presence of Na dodecylate and per aminoacid content) were alpha--55,000; beta--51,000; gamma--35,000; epsilon--13,500. Stoichiometry was established as 3 alpha, 3 beta, 3 gamma (1-2) epsilon. Steric hindrance prevents access to terminal aminoacids. Interaction of antibodies with solubilized and with membrane-attached SfF_1 was evaluated by antibody inhibition of ATPase activity and their precipitation of the proteins. The antibody-inhibition capacity supported the finding of the beta subunit as the active center. The alpha and beta subunits are apparently in the same plane; the SfF_1 is sited on the biological membrane in a zone of transition from a non-polar to a polar area. A model has been drawn to portray the interaction of the SfF_1 with the membrane, showing the relative positions of the subunits and the formation of a proton-conduction pathway.

Experimental data appended indicate extensive reliance on foreign (Hungary, US, Sweden, Switzerland) reagents and instruments in this research. Figures 7; references 23: 4 Russian, 19 Western (two by Soviet authors). [614-8586]

USSR

UDC 575.11:576.858.9

HYBRID pSD1 PLASMID CONTAINING THE IMMUNITY REGION OF BACTERIOPHAGE LAMBDA

Moscow GENETIKA in Russian Vol 15, No 7, Jul 79 pp 1191-1198 revised manuscript received 14 Aug 78

DIKAREV, S. D., SINEOKIY, S. P. and STEPANOV, A. I., All-Union Scientific Research Institute for the Genetics and Breeding of Industrial Microorganisms, Moscow

[Abstract] A hybrid plasmid, designated as pSD1, was produced by using a DNA mixture of plasmid RSP2124 and phage lambda-biol for transformation of *E. coli* K-12. The resultant pSD1 plasmid contained a 17.2 Mdal DNA, which corresponded to the total molecular weight of RSP2124 DNA and that of fragment C+D of phage lambda-biol, the latter identified by electrophoretic mobility in agarose. In addition to C+D, pSD1 also possessed fragments with the mobilities of fragment B and gene N of the lambda phage. Inhibition of phage lambda-vir in the cells containing pSD1 was due to unusually high synthesis of repressor cI, which exceeded 5-fold its synthesis in monolysogenic cells, and was ascribed to initiation of transcription from promoter P and that of the RSP plasmid. RSP2124 was also used in the production of a hybrid plasmid pSD2 which contained genes R, A, and J of phage lambda, and in the construction of a hybrid plasmid pSD3 which carried genes P and Q. Figures 5; references 21: 2 Russian, 19 Western. [520-12172]

USSR

UDC 575.24.1

CONTROL OF PLASMID INCOMPATIBILITY: CHARACTERISTICS OF THE BIREPLICON HYBRID pas8 AND ITS DELETION MUTANTS

Moscow GENETIKA in Russian No 6, 1979 pp 972-988 manuscript received 5 Sep 78

SAKANYAN, V. A., KRUPENKO, M. A., RYABCHENKO, L. YE., PERMOGOROV, V. I. and ALIKHANYAN, S. I., All-Union Scientific Research Institute for the Genetics and Breeding of Industrial Microorganisms, Moscow

[Abstract] Plasmid incompatibility was investigated by using plasmid pAS8 which was constructed by linking the DNA molecules of plasmids RP4 and ColE1. pAS8 evidenced incompatibility in terms of both components; however, while P-specificity was equivalent to that seen in RP4, ColE1 specificity was attenuated in comparison with the autonomous ColE1 replicon, namely, P specificity was evident in both directions: pAS8 both eliminates and is eliminated by representatives of the Inc P group. Incompatibility attributable to the ColE1 component appeared to be unidirectional in that the hybrid pAS8 eliminated ColE1, but the reverse did not occur. Similar observations applied to some of the pAS8 deletion mutants; this phenomenon was unrelated to a change in the number of copies of the plasmid DNA due to stringent control of replication. These findings indicate the existence of a control mechanism for incompatibility which, apparently, does not involve replication genes. Figures 6; references 40; 9 Russian, 31 Western. [523-12171]

USSR

UDC 612.825.58

INTERFERENCE-FREE MECHANISMS IN THE CAT VISUAL SYSTEM IN UNILATERAL CORTICAL POLARIZATION

Moscow BIOLOGICHESKIYE NAUKI in Russian No 7, 1979 pp 48-55 manuscript received 9 Mar 78

UDALOVA, G. P. and ABDUAKHADOV, A. S., Chair of Higher Nervous Activity, Leningrad State University imeni A. A. Zhdanov

[Abstract] Since it has been demonstrated that the inhibitory effects of light noise on cortical evoked potentials were less pronounced in binocular vision than in monocular vision, as well as in cats with sectioned corpus callosum, acute experiments were carried out on intact cats and in cats with a resected corpus callosum to study the effects of unilateral cortical polarization of the parastriate cortex on evoked potentials in fields 17 and 18 in the presence of a binocular signal alone or in a signal + noise scheme. During anodal polarization and in the after-period changes were seen in the evoked potentials, the amplitudes of which depended on the intensity of the photostimulus and cortical background activity. In the polarized cortex of intact animals noiseproofing mechanisms were enhanced, whereas in the unpolarized cortex they were either unaffected or weakened. Following sectioning of the corpus callosum the noiseproof mechanisms were further potentiated and expressed in fields 17 and 18 of both cerebral hemispheres. Figures 2; references 21: 2 Western, 19 Russian.

[525-12172]

USSR

UDC 007:616.12-073.97

STATISTICAL ALGORITHM FOR STRUCTURAL ELECTROCARDIOGRAM ANALYSIS

Kiev KIBERNETIKA in Russian No 3, 1979 pp 91-95 manuscript received 26 Apr 77

VALUZHIS, A. K. and RASHIMAS, A. P.

[Abstract] Mathematical arguments are presented for the analysis of EKG wave-forms on the basis of a solutions algorithm in which a priori probabilities are assigned to the different elements (fronts) of the EKG and their sequences, in which the sequences of fronts are treated as vectors. The resultant statistical model may serve for computer identification and analysis of the various EKG patterns. Figures 5; references 15:

4 Western, 11 Russian.

[521-12172]

USSR

UDC 612.825.4.8.3+612.833.81+591.51.2.4

PARTICIPATION OF THE FRONTAL CORTEX OF PRIMATES IN THE ORGANIZATION OF
SHORT-TERM MEMORY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 247, No 4, 1979 pp 997-1000

BATUYEV, A. S., ORLOV, A. A. and PIROGOV, A. A., Leningrad State University
imeni A. A. Zhdanov

[Abstract] Electrophysiologic studies were conducted on alterations in the activities of S. principalis neurons of Macaca rhesus during the interval between the warning and conditioned stimuli, in response to the conditioned and the trigger stimuli since the latter interval may reflect neuronal mechanisms of short-term memory. Analysis of the electric activities in both cerebral hemispheres in response to ipsilateral and contralateral conditioned stimuli, demonstrated that the average frequency of discharges during the delay between the contralateral conditioned and the trigger stimuli was approximately twice as great as when an ipsilateral conditioned stimulus was employed. Essentially 4 types of neuronal activities were detected: a) neurons showing an increase in discharge frequency in the initial phase of the interval; b) neurons showing an increase in the discharge frequency in the middle of the delay interval; c) neurons exhibiting an increase toward the end of the interval; and d) neurons exhibiting successive activation during the interval. Average discharge frequency consisted of 4-7 waves/sec, i.e., within the theta rhythm range. Differences in the discharge patterns of the left and right hemispheric neurons were interpreted to reflect specific coding of ipsi- or contralateral conditioned stimuli and maintenance of the signal information in the short-term memory bank. Figures 2; references 8: 4 Russian, 4 Western. [514-12172]

USSR

UDC 612.886+612.84

CHANGES OF OPTOKINETICS, POSTOPTOKINETICS AND REVERSE POSTOPTOKINETIC
NYSTAGMI AFTER BILATERAL LABYRINTHECTOMY

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I. M. SECHENOV in Russian
Vol 65, No 5, May 79 pp 687-693 manuscript received 6 Jun 78

NEVEROV, V. P. and KORYUKIN, V. YE., Laboratory of the Physiology of Vestibular Apparatus, Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences, Chair of Otolaryngology, Military Medical Academy imeni S. M. Kirov, Leningrad

[Abstract] The effect of bilateral labyrinthectomy on the amplitude-frequency characteristics of optokinetic (OKN), postoptokinetic (POKN) and reverse postoptokinetic (RPN) nystagmi has been studied on rabbits. It has been shown that labyrinthectomy led to identical changes in all animals: a sharp decrease in the frequency of OKN and RPN and in the duration and number of beats of POKN from the moment of the interruption of optokinetic stimulation. These changes lasted a long time. Labyrinthectomy had no effect on amplitude. On the basis of this study and results of other investigators, it would appear that labyrinthectomy affects the functions of the slow tracing movement system, leaving the fast saccadic movement (judging by the amplitude) basically intact. At this time no one knows how the neuron function in the network of directional sensitive elements is affected by labyrinthectomy; one can only assume that they are diminished, as reflected by the frequency of OKN and RPN. Figures 2; references 20: 8 Russian, 12 Western.
[377-7813]

USSR

UDC 612.273+612.17

EFFECT OF THE ADAPTATION TO HIGH ALTITUDE HYPOXIA ON THE ADRENORE-ACTIVITY OF THE HEART AND ON THE STATE OF THE ADENYL CYCLASE AND PHOSPHODIESTERASE SYSTEMS OF THE MYOCARDIUM

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I. M. SECHENOV in Russian
Vol 65, No 5, May 79 pp 727-732 manuscript received 5 Jul 78

MEYERSON, P. Z., KRAVETZ, E. G., PSHENNIKOVA, M. G., GOLUBEVA, L. YU., KARCHEVSKI, P. and WOLLENBERGER, A., Institute of General Pathology and Physiology, USSR Academy of Medical Sciences; Central Institute of Studies of Heart Regulation and Blood Circulation, GDR Academy of Sciences, Berlin-Buch, GPR

[Abstract] Adaptation of a body to the conditions of high altitude hypoxia is normally accompanied by changes in adrenergic regulation of the heart, manifested by intensified and accelerated liquidation of a positive inotropic response of the heart to noradrenaline. In spite of several hypotheses, the mechanism of this phenomenon remains unclear. To shed light on this problem, the contractive function and adrenoreactivity of heart were compared to the activity of adenylycyclase and phosphodiesterase systems of the myocardium on experimental animals. It was shown that changes in the activity of intracellular systems responsible for the formation and breakdown of cyclic AMP play an important role in the mechanism of this increased adrenoreactivity of heart. Figures 2; references 14: 4 Russian, 10 Western.
[377-7813]

REGULATION OF BREATHING UNDER CONDITIONS OF CHANGING GAS MEDIUM DENSITY AND UNDER RESISTIVE LOAD

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I. M. SECHENOV in Russian
Vol 65, No 5, May 79, pp 733-740 manuscript received 8 Jun 78

KONZA, E. A., Institute of Physiology imeni I. P. Pavlov, USSR
Academy of Sciences, Leningrad

[Abstract] The goal of this study was to compare the characteristics of breathing regulations under stable conditions and normal external resistance, while breathing gases with different densities, using helium and SF₆ as diluents. The relationship between vagal and extravagal mechanisms of the breathing reactions was investigated on cats. Increased resistance during breathing showed no changes in the ventilation; it led to a decelerated respiratory cycle and increased work of respiratory muscles. Breathing a hypercapnic mixture led to an even greater work of respiratory muscles, a drop in lung ventilation and increased pressure of CO₂ in the alveolar gas. Inhalation of a helium-air mixture showed no changes, while SF₆-O₂ mixture resulted in a behavior analogous to that observed with additional resistance. After bilateral vagotomy, the compensatory increase in the work of respiratory muscles persisted in response to the resistance load; the reaction to breathing of high density mixture disappeared. During the optimization of the ventilation regimen, the vagal mechanism played an important role in connection with the receptor functions of bronchi and lungs. Figures 2; references 20: 8 Russian, 12 Western.

[377-7813]

ANALYSIS OF FOCAL POTENTIALS OF CAT CEREBRAL CORTEX ACTIVATION OF CEREBELLO-THALAMO-CORTICAL PROJECTION SYSTEMS

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I. M. SECHENOV in Russian
Vol 65, No 5, May 79 pp 649-655 manuscript received 23 Aug 78

PAPOYAN, YE. V. and AGANESYAN, E. A., Laboratory of the Physiology of the Central Nervous System, Institute of Physiology imeni L. A. Orbeli, ArmSSR Academy of Sciences, Yerevan

[Abstract] Topographical distribution of the responses of cerebral cortex to stimulation of cerebellum nucleus and the ventro-lateral and ventro-anterior nuclei of the thalamus were studied. Analysis of focal cortex

potentials was carried out. It showed that in the pericruciate cortex, the reversal of the surface potential occurred 0.5-0.6 mm from the surface, the amplitude maximum being reached at 2.0 mm depth, while in the associative parietal cortex, the focal potential reversed at 0.2-0.3 mm, with a maximum at 1.0 mm. Cerebellar responses in the pericruciate cortex are mediated through the ventro-lateral nucleus of the thalamus, whose neuron axons form synapses in the III-IV layers of the cortex. In the parietal cortex they are mediated through the ventral anterior nucleus of the thalamus, whose neuron axons form synapses in more superficial layers. The cerebellum-thalamus-cortex projection system spans through the pericruciate and parietal cortex, being interconnected by associative fibers. Figures 4; references 18: 3 Russian, 15 Western.

[377-7813]

USSR

UDC 612.825.5

DISTRIBUTION OF RESPONSES AMONG NEURONAL POPULATIONS IN THE SOMATOSENSORY CORTEX FOLLOWING DIFFERENT STIMULI

Neurofiziologiya Akademii Nauk SSSR in Russian Vol 246, No 5, 1979 pp 1263-1277 manuscript received 12 Feb 79

GRATV, Yu. G. and PANTELEYEV, S. S., Institute of Physiology imeni I. P. Pavlov, Leningrad

[Abstract] Studies were conducted on cats to determine the relationship between overall EEG and the responses of a given population of somatosensory neurons in relation to different stimuli (electrocutaneous, sound, and acoustic stimulation of the midbrain reticular formation, of equal duration and adequate for EEG activation). In summary, the resultant electroencephalographic data demonstrated that both the EEG and multineuronal impulsionation were activated. Application of a discriminator function to multineuronal activity revealed that there existed defined differences between the EEG and multineuronal activity (MA), and among the MA responses to the different stimuli. While EEG was uniformly activated by all responses, electrocutaneous stimulation evoked activation in 67% of neurons in the area of the cortex under study and the other two stimuli elicited only 47% activation. The other neurons responded with inhibition or various patterns of sequential discharges. It appears that coding of sensory information may also involve its distribution patterns of responses. The activation of a relatively large number of neurons in the somatosensory cortex by sound supports the contention that this area of the cortex is involved in the integrative activation of the brain as far as convergence of sensory impulsionation is concerned. Figures 3; references 7: 1 Hungarian, 1 Western, 5 Russian

[135-2172]

EFFICACY OF HYPOTHERMIA IN PROTECTING AGAINST HYPOXEMIA (RESULTS OF A MATHEMATICAL ANALYSIS)

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 246, No 5, 1979 pp 1259-1263 manuscript received 1 Feb 79

KISLYAKOV, YU. YA. and IVANOV, K. P., Institute of Physiology imeni I. P. Pavlov

[Abstract] On the basis of a mathematical model for the diffusion of oxygen along concentration gradients from the blood stream to a cortical neuron, quantitative evaluations were made of the physiologic effectiveness of hypothermia in protecting against the pathologic effects of hypoxemia. Utilizing experimentally derived data on the relationship among the metabolic rate, the respiratory rate, oxyhemoglobin dissociation curves, etc., calculations were made which showed that in normoxemia ($p_{aO_2} = 94$ tor) the p_{aO_2} levels in cortical neurons at 37°C, 28°C, and 20°C were, respectively, 16, 22, and 24 tor; in hypoxemia, $p_{aO_2} = 50$ tor, the corresponding values were 0, 9, and 16 tor at the respective temperatures. Thus, essentially normal intracellular oxygen tensions can be maintained under hypothermic conditions (20°C) in conjunction with hypoxemia ($p_{aO_2} = 50$ tor). The two major factors responsible for adequate intracellular oxygen concentrations were the temperature-related depression of the metabolic rate which favored an increase in capillary oxygen tension while depressed tissue oxygen levels favored an increase in oxygen saturation of the tissues and, two, a shift to the left of the dissociation curve at 37, 28, and 20°C leading to oxyhemoglobin concentrations of 78, 90, and 95%, respectively, at $pO_2 = 50$ tor. Figures 1; references 15: 6 Russian, 9 Western.
[535-12172]

MECHANISM OF ADAPTIVE CONTROL OF COMPLEX MOTOR SYSTEMS (CONTROL BY POSITION AND ACCELERATION)

Moscow BIOFIZIKA in Russian Vol 24, No 4, Jul/Aug 79 pp 733-740 manuscript received 26 Feb 77

PENEV, G. D. and TAIROV, O. P., Laboratory of Sensorimotor Systems, Leningrad State University imeni A. A. Zhdanov

[Abstract] Previously, a mathematical model was developed for the adaptation processes of a motor system using information on the rate of the position change of individual links. In this paper adaptive control is analyzed for

the situations in which the information on the absolute value of component angles or the acceleration of their movement is used. Algorithms for position control, change of position and acceleration control have been reported. The principal condition of adaptive control in the proposed model is the solution of the inequality $|\phi(t) - \phi^*(t)| < \varepsilon(t)$. It has been proposed that the nervous system could use algorithms to solve this inequality with different types of information and with different criteria for optimization selected from individual experiments and the solution at hand. In this system it is possible to use measurable control signal leaps in identifying the state of the system; as a result of this, it is possible to correct the on-going movement by measured control signal leaps. Figures 2; references 7: 5 Russian, 1 Western.

[731-7813]

USSR

UDC 582.288.42:577.154.35

INFLUENCE OF NUTRIENT MEDIUM COMPONENTS ON CONSTITUTIVE SYNTHESIS OF PECTOLYTIC ENZYMES OF *PENICILLIUM DIGITATUM* SACC. 24 P

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979 pp 213-216 manuscript received 17 Jul 78

LOBANOK, A. G., MIKHAYLOVA, R. V. and SAPUNOVA, L. I., Institute of Microbiology, BSSR Academy of Sciences, Minsk

[Abstract] Synthesis of pectinases by *P. digitatum* 24 P had been shown earlier not to be a function of carbon and nitrogen source in the medium (Lobanok, 1977). The present article describes further study of the nutritional physiology of the *P. digitatum*; conditions of cultivation and methods of assay of activity of produced enzymes were described in earlier articles of the author (1976, 1977). In this article, the source of phosphorus, a fundamental nutrient, was tested; sources were: $\text{NH}_4\text{H}_2\text{PO}_4$; $(\text{NH}_4)_2\text{HPO}_4$; $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$; $\text{Ca}_3(\text{PO}_4)_2$; NaH_2PO_4 ; NaH_2PO_4 ; $\text{Fe}_3(\text{PO}_4)_2$; KH_2PO_4 -- supplying 0.023% P. Medium pH was set at 5.0-5.5. Glucose was the carbon source. Effect of the various sources of P on the constitutive synthesis of the pectolytic enzymes is tabulated. All P sources result in synthesis; the best sources were seen to be KH_2PO_4 , $\text{NH}_4\text{H}_2\text{PO}_4$ and $(\text{NH}_4)_2\text{HPO}_4$. The ferric phosphate accelerated fungus growth, but the iron apparently inhibited pectinase synthesis. The P source was judged not to be a key factor in the enzyme synthesis. Influence of medium concentrations of glucose, NaNO_3 , KH_2PO_4 , MgSO_4 and KCl was tested; results are tabulated. Glucose levels of 0.02 to 2.0% were optimal; levels of 7.5% of sodium nitrate tend to inhibit enzyme synthesis and of 9% inhibit fungus growth and enzyme synthesis; when no KH_2PO_4 is supplied, the fungus does not grow, while levels from 0.001 to 0.01% appear optimal for growth and levels to 4% have no additional value; KCl and MgSO_4 are seen to have less importance to fungus growth. Figure 1; references 7: 4 Russian, 3 Western. [614-8586]

USSR

UDC 575.1:581.167:633.11

VARIABILITY OF GENETIC PARAMETERS IN DIALLELIC ANALYSIS OF QUANTITATIVE TRAITS IN COMMON SPRING WHEAT

Moscow GENETIKA in Russian Vol 15, No 7, Jul 79 pp 1243-1254 manuscript received 20 Feb 78

TSIL'KE, R. A., KACHUR, O. T. and SADYKOVA, S. A., Siberian Scientific Research Institute of Agriculture, Omsk

[Abstract] Genetic studies were conducted on the production of grain mass per spike by 7 common spring wheats (Saratovskaya 29, Milturum 553, Pirotrix 28, Grecum 114, World Seeds 1812, World Seeds 1877) in 1972 and 1973 under conditions prevalent in Siberia. The experiments involved planting densities equivalent to 25 and 250 seeds/m². Evaluation of the results with the parental varieties and F₁ and F₂ hybrids indicated that productivity was highly dependent on the density of sowing, conditions of vegetation, and on the generation of the hybrids. In general, highest yields were obtained with Pirotrix 28 and Grecum 114; furthermore, planting densities of 25 seeds/m² exceeded those obtained with 250 seeds/m² in terms of yields, and hybrids as a rule exceeded parental strains in grain mass per spike. Component analysis revealed that productivity was controlled by an additive-dominant genetic system, and that genes with an additive effect made a greater contribution to productivity than did genes with an allelic form of interaction. The sharp fall in yield in F₂ in comparison with F₁ in some cases, indicated that in some hybrids superdominance was a key factor. None of the F₁ hybrids exceeded Pirotrix 28 in the number of grains per spike, nor Grecum 114 in the weight of 1000 grains. This study demonstrated that the varieties of common wheat under investigation differed markedly in genetic potential for spike productivity. Figures 2; references 10: 5 Western, 5 Russian.

[520-12172]

USSR

UDC 633.11.575.2:575.1:664.6/7

FORMATION OF GRAIN QUALITY AND HERITABILITY OF SOME GRAIN FEATURES IN HYBRIDIZATION OF WINTER WHEATS

Kiev TSITOLOGIYA I GENETIKA in Russian Vol 13, No 3, Mar/Apr 79 pp 187-193
manuscript received 16 Feb 78

BIBYAKIN, V. M. and PISKUNOVA, G. V., Scientific Research Institute of Agriculture of the Southeast, Saratov

[Abstract] Research is done to determine the nature of formation and the degree of genetic determination of protein and gluten, as well as the rheological properties of dough made from flour of hybridized winter wheats. The materials used in the hybridization were winter and spring wheat varieties characterized by a high level of interesting properties: Mironovskaya-618 (M-808), Atlas-66 (A-66), Ukrainka (Uk.), Purdue-4930 (Purdue), Red River-68 (RR-68) and Saratovskaya-29 (S-29). It is found that reciprocal hybrids P₂ and F₃ from crossing M-808 with A-66, Uk., S-29 and RR-68 have heritability in the broad (H²) and narrow (h²) sense with respect to protein content in the grain (H² = 0.111-0.457, h² = 0.300-0.308), gluten content in the flour (H² = 0.128-0.468), valorimetric number (H² = 0.175-0.758, h² = 0.072-0.452) and dough strength (H² = 0.077-0.543, h² = 0.323-0.423). References 10: 2 Russian, 8 Western.

[511-6610]

USSR

UDC 581.14:582.285.2

FEATURES OF IN VITRO GROWTH AND SPORULATION OF PUCCINIA GRAMINIS F. SP. TRITICI, A CAUSATIVE AGENT OF WHEAT STEM RUST

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 200-300 manuscript received 15 Apr 78

SHASHKOVA, L. S., MAZIN, V. V. and ANDREYEV, L. N., Main Botanical Garden, USSR Academy of Sciences, Moscow

[Abstract] This is an extension of earlier work by the Botanical Garden which had described growth of race 21 of the agent (1971), growth of the pathogen in various artificial media (1972) and culture sporulation (1976). Photographs are presented here taken on live, non-fixed materials. The artificial media employed are described by Andreyev in his earlier report. Comparison of uredospores of the wheat stem rust from leaves of the host and from the cultures is tabulated; photographs are presented of the agent grown on the artificial medium and of formation of the generative hyphae of the rust in a culture. The uredospores produced in the culture essentially retain their virulence. Figures 3; references 7: 3 Russian, 4 Western. [614-8586]

USSR

UDC 620.193.8:582.28

ADSORPTION OF FUNGUS SPORES ON SYTALLAE AS AFFECTED BY THEIR FUNGUS RESISTANCE

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 208-213 manuscript received 1 Aug 78

BOBKOVA, T. S., CHEKUNOVA, L. N., ZLOCHEVSKAYA, I. V. and BESSMERTNAYA, Z. G., Department of Lower Plants, Moscow State University imeni M. V. Lomonosov

[Abstract] Earlier work (Bobkova, 1979) to prevent fungus growth on sytallae established that overgrowth of the latter could be prevented by introduction into the sytallae of very small amounts of copper and cobalt oxides (but not of tin, lead, niobium or vanadium). The present article inquires into the nature of this prevention. The sytallae were lithium-aluminosilicates. The absence of growth of the fungi (nine, including *A. niger* v. Tiegh, *A. versicolor*, *A. flavus* Fr., etc.) on sytallae treated with CuO and CoO was not due to the fungicidal properties of those oxides. Using *Helminthosporium sativum* Pann., King et Bakke, the capacity of fungi to absorb on sytallae was assayed and is tabulated; adsorption of fungus spores is more prolonged than adsorption of bacterial cells. A correlation was

found between the intensity of fungus growth on sytallae and adsorption of spores of the fungi on the sytallae. When the adsorption capacity of the sytallae is decreased, fungus development on their surface is inhibited. Strength of *H. sativum* attachment to sytallae, as a function of presence of the metallic oxides, is shown graphically. Figures 2; references 6: 4 Russian, 2 Western.

[614-8586]

USSR

UDC 632.938:633.11:582.285.2

CROSS PROTECTION OF WHEATS AGAINST BROWN RUST

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 236-240 manuscript received 28 Jul 78

TYUTEREV, S. L. and KSENDZOVA, E. N., All-Union Institute of Plant Protection, Leningrad

[Abstract] Citing foreign literature findings of development of cross protection of wheat, with compatible and non-compatible pathogens, this article reports study of the influence of several environmental factors on wheat brown rust resistance. Saratovskaya 29 wheat sort was examined; the pathogen was *Puccinia triticina* Eriks. race 77 (*P. recondita*). Cross protection of the wheat from the pathogen used by brown rust causative agents *P. dispersa* Eriks. et E. Henn (Leningrad population) and oat crown rust *P. coronifera* Kleb. f. sp. *avenae* Eriks (Baltic coast population). The wheat was grown in a hothouse. Effect of various doses of the inducing pathogens on induction of resistance, duration of the protective action induced and the effect of temperature on the degree of protection (in % of pustules as compared to controls) are tabulated. Quality of induced protection is found to be a function of temperature, amount of spores of the non-compatible pathogen used and time of development of plant response to inoculation. References 21: 2 Russian, 19 Western.

[614-8586]

PROTEOLYTIC ACTIVITY OF BASIDIOMYCETES OF THE APHYLLOPHORALES ORDER.
II CASEINASE

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 217-220 manuscript received 27 Jun 78

NIZKOVSKAYA, O. P., FEDOROVA, L. N. and DROZDOVA, T. N., Botanical Institute
imeni V. L. Komarov USSR Academy of Sciences, Leningrad

[Abstract] This work used aphyllaphor fungi from the collection of higher basidiomycetes of the Botanical Institute; proteolytic activity in the culture filtrates of 58 strains (39 species) from the families Polyporaceae, Hymenochaetaceae and Ganodermataceae was assayed. Substrate used was a 25% solution of casein in a phosphate buffer, pH 6.2. Growth of the studied cultures in the period of greatest formation of biomass and maximum proteolytic activity is tabulated. Maximum activity occurred, in most of the strains, in the period of greatest mycelium formation or somewhat later, sometimes during autolysis. Proteolytic activity of the fungi was generally low. References 14: 7 Russian, 7 Western.
[614-8586]

RESISTANCE OF WHEAT TO ROOT ROT

Leningrad MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol 13, No 3, 1979
pp 253-259 manuscript received 7 Jul 77

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[Abstract] This is essentially a review article. Foreign contributions as well as Soviet work are cited. Pointed out are the shortcomings of chemical agents to combat the various agents of root rot and the need to identify wheat sorts which possess resistance--the latter task being extremely difficult because of the number and complexity of causative agents, the role of ecology and the intra-species variations among the agents. Reliance on soils for self-purification has suggested preparation of artificially-infected earth which then could spontaneously remove the agents (Zdrazhevskaya, 1970). The history of search for resistant sorts of wheat is outlined, with ways to develop resistance (e.g., hybridization, Sallans, Tinline, 1965). Shevchenko, et al. (1970) reported relative resistance to root rot agents on the part of steppe ecotypes of wheat in the Southeast

USSR and the Volga valley; more detail on this resistance was reported by Korshunova, et al. (1970) who list a number of wheat sorts tested--no completely immune sorts were found. The article's authors found Bezenchukskaya 129 sort to exhibit only weak susceptibility. USSR winter wheats are not highly resistant, though several (cited) show variations in this regard. Sorts in the Ukraine with strong resistance have been found. The authors note that literature articles largely fail to discuss the nature of resistance of wheats to the various causative agents or patterns of inheritance of resistance, and they feel research efforts should be extended in these directions. References 62: Russian 23, Western 39.
[614-8586]

USSR

UDC 575.1:582.281

GENETIC STUDY ON BENEMYL-RESISTANT MUTANTS OF THE FUNGUS *BEAUVERIA BASSIANA*

Moscow GENETIKA in Russian No 6, 1979 pp 1124-1126 revised manuscript received 23 Aug 78

YURCHENKO, L. V., Leningrad Institute of Nuclear Physics imeni B. P. Konstantinov, USSR Academy of Sciences

[Abstract] Investigations were conducted to determine the nature of resistance to benemyl (methyl-(butylcarbamoyl)-2-benzimidazole carbamate) by mutants of the entomophagic fungus *Beauveria bassiana*, obtained by seeding spores of the fungus on solid media containing 8 mg/liter of benemyl. Resistant mutants were detected with a frequency of $1-3 \times 10^{-6}$, of which only 10-15% retained the capacity for spore formation. Further studies demonstrated that the benemyl-resistant mutants had lost the capacity for heterokaryon formation, and such studies also indicated that resistance was under the control of nuclear genes. Investigation of 12 mutants showed that in 7 mutants the resistance was dominant and in 5 cases recessive. References 5: 2 Western, 3 Russian.

[523-12172]

USSR

UDC 62-50:614

MANAGEMENT PROBLEMS IN PUBLIC HEALTH

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 6, 1979 pp 145-153 manuscript received 5 Dec 78

BORODKIN, L. I., KLEMENT'YEV, A. A., PETROVSKIY, A. M., and YASHIN, A. I.,
Moscow

[Abstract] The public health system (PHS) is a complex entity involving many branches of the national economy. It is a rapidly developing system thanks to scientific, technical and medical progress. The current system of PHS management is not always capable of keeping abreast of these developments. In part, the problem of managing PHS is due to the time lag between the investment of resources and visible end results. Two approaches are discussed in this paper to the solution of this problem: development of control methods based on a system of criteria for evaluating the functions at various levels of PHS and development of dialogue systems: decision maker-PHS model as one of the principal means of decision reaching at higher echelons of PHS. In this respect it is important to develop a solid data base. A number of already developed models has been reviewed. Future effort should concentrate on subsystem modelling based on the current demographic data base and on development of human-machine dialogue procedures. Figures 2; references 27: 13 Russian, 14 Western.
[521-7813]

USSR

UDC 539.16.047

CREATINEKINASE ACTIVITY OF RAT TISSUE DURING COMBINED EFFECT OF β -RADIATION AND BODY HEATING

Yerevan BIOLOGICHESKIY ZHURNAL ARMENII in Russian Vol 32, No 5, May 79
pp 402-406 manuscript received 25 Sep 78

MATYUSHICHEV, V. B., TARATUKHIN, V. R., SHAMRATOVA, V. G. and
YUZNAKOVA, G. A., Chair of Biochemistry, Leningrad State University

[Abstract] Many personnel are exposed to β -radiation in association with elevated temperatures at their working places. Creatinekinase activity of the brain and liver tissue of rats exposed to β -irradiation and elevated temperatures has been studied. Creatinekinase is one of the key enzymes involved in energy exchange; it plays an important role in the repair processes of cells damaged by irradiation. Rats kept at 36°C, relative humidity 80-90 percent, were exposed to ^{85}Kr irradiation at doses of 2.5, 3.05, 4.45 and 7.4 Krad. Creatinekinase activity was determined 5, 12, 19 and 26 days after exposure. It was shown that exposure to heat increased the effect of the lowest radiation dose, but decreased the effect of the highest dose. When organ-specific changes were analyzed, no trends were noticeable in liver, while 3 out of 4 doses used showed diminished radiation effect with hyperthermia. The postradiation behavior of creatinekinase activity in the liver is evidently determined by metabolic characteristics of hepatocytes.

References: 4 Russian.

[528-7813]

USSR

UDC 575.24

p-AMINOBENZOIC ACID IN THE REPAIR OF UV AND GAMMA RADIATION-INDUCED LESIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 247, No 1, 1979 pp 231-234
manuscript received 30 Apr 79

RAPOPORT, I. A., corresponding member, USSR Academy of Sciences,
VASIL'YEVA, S. V. and DAVNICHENKO, L. S., Institute of Chemical Physics,
USSR Academy of Sciences, Moscow

[Abstract] Several strains of *E. coli*, differing in the activities of DNA repair enzymes, were subjected to 10-1500 erg/mm² of UV radiation or gamma radiation from a ^{137}Cs source (456 rad/min) in the presence or absence of 0.0001-0.01 M PABA (p-aminobenzoic acid). The UV studies demonstrated that PABA increased the viability of the different strains 1.5 to 100 fold while it depressed the mutation rate 30 to 600 fold. A similar, but much less pronounced, trend was evident with the gamma irradiation. In view of the

fact that PABA was previously found to exert a similarly protective effect with a chemical mutagen, N-nitrosomethylurea, it appears that it belongs to a class of compounds possessing novel genetic properties tentatively designated as "reparagens", which are deserving of further experimental attention. References 11: 5 Russian, 6 Western.
[514-12172]

USSR

UDC 575.224.23

NEW PHENOMENON IN THE WAVE-LIKE KINETICS OF RADIATION MUTAGENESIS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 246, No 5, 1979 pp 1235-1238
manuscript received 2 Feb 79

DUBININ, N. P., academician, SARTAYEV, A. S., ROMANOV, V. P. and
NEMTSEVA, L. S., Institute of General Genetics, USSR Academy of Sciences,
Moscow

[Abstract] Experiments conducted with the seeds of *Crepis capillaris* demonstrated that either pre- or postradiation (^{137}Cs gamma rays, 1.0 kR) storage in the dry state at 26°C of seeds irradiated in the presynthetic phase of the cell cycle resulted in the appearance of a series of maxima and minima (wave-like pattern) in the incidence of chromosomal mutations. Comparison of the patterns (kinetics) for pre- and postradiation storage experiments revealed that the peaks in the former case exceeded the mean frequency of chromosomal mutations per cell seen in irradiated but not 'stored' (control) cells, while in the latter case the maxima were generally below the control incidence depending on experimental conditions. Similarly, preirradiation storage of seeds irradiated with 0.3 kR gamma rays during the postsynthetic phase of the cell cycle also enhanced the incidence of chromatid mutations. The results showed that the state or conformation of DNA prior to the exposure of a mutagen constitutes an important factor in the course of mutagenesis. Figures 1; references: 11 Russian.
[535-12172]

USSR

PROBLEMS OF THE BIOLOGIC ACTIVITY OF SECONDARY METABOLITES AND THEIR
METABOLIC REGULATION

Moscow USPEKHI SOVREMENNOY BIOLOGII in Russian No 3, 1979 pp 474-477

KEFELI, V. I. and ZAPROMETOV, M. N.

[Abstract] Several days of the 12th Session of the Federation of European Biochemical Societies, held in Dresden (East Germany) July 3-9, 1978 were devoted to the biochemical aspects of secondary metabolites (antibiotics, vitamins, hormones, alkaloids, polyphenols, etc.). The reports, communications, and exhibit poster sessions devoted to the subject of secondary metabolites attracted over 150 participants, which testifies to the maturity and interest in this field and to the need for including such topics in future meetings.

[545-12172]

USSR

UDC 575.1:636.2

INHERITANCE OF MASTITIS RESISTANCE IN DAIRY CATTLE

Moscow GENETIKA in Russian Vol 15, No 7, Jul 79 pp 1298-1303

KARMANOVA, YE. P. and BOLGOV, A. YE., Petrozavodsk State University imeni O. V. Kuusinen

[Abstract] Statistical studies were conducted on the heredity of mastitis in Kholmogorskiy, Brown Latvian, and Ayrshire dairy cattle on the basis of electrophoretic milk protein patterns (elevation of a fraction between κ and β casein, spread of α_{s1} casein fraction to 5-7 fractions, etc.) seen in milk analysis of 2108 cows in Karelia during the 1965-1977 period. The results showed that the incidence of mastitis was 28.9-39.9% among the Brown Latvian cows, and 18.1-18.7% among the Kholmogorskiy animals ($P < 0.01$). The lowest incidence was exhibited by the Ayrshire cows (1.96-10%). Paternal inheritance was highly significant in the Kholmogorskiy cattle in predisposition to mastitis with $h^2 = 0.393-0.4058$, but insignificant in Brown Latvian. Adjustment of the Kholmogorskiy cattle data for age of cows yielded $h^2 = 0.181-0.243$ ($p < 0.05$), supporting paternal inheritance as a significant factor. Evaluation of 124 mother-daughter pairs yielded a coefficient of heredity of $h^2 = 0.412$ for the Kholmogorskiy cattle and 0.542 for the Brown Latvian breed. These findings suggest that in the control of mastitis, both occult and apparent cases must be taken into consideration, and that due attention must be accorded to genetic predisposition and appropriate breeding practices. Figures 1; references 7: 3 Russian, 4 Western.

[520-12172]

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